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OF
OPHTHALMOLOGY

THIRD SERIES FOUNDED BY EDWARD JACKSON

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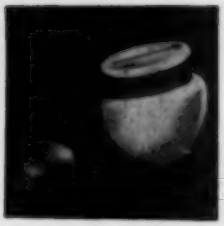

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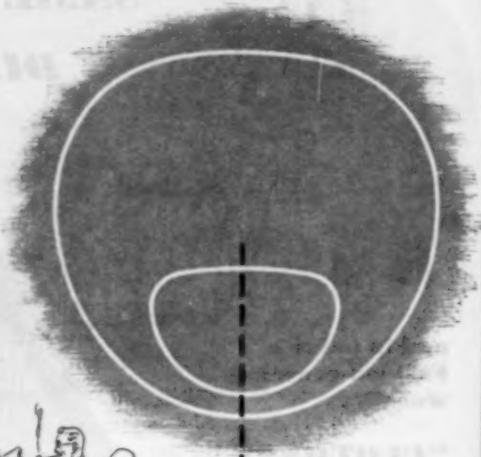

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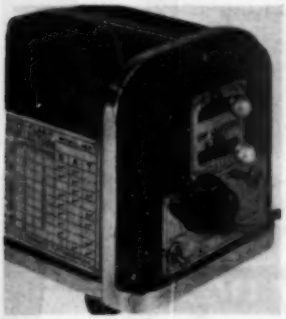

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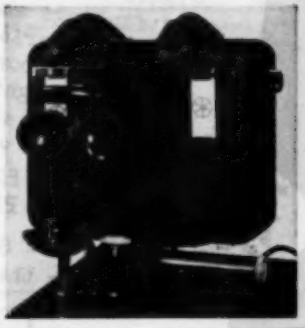

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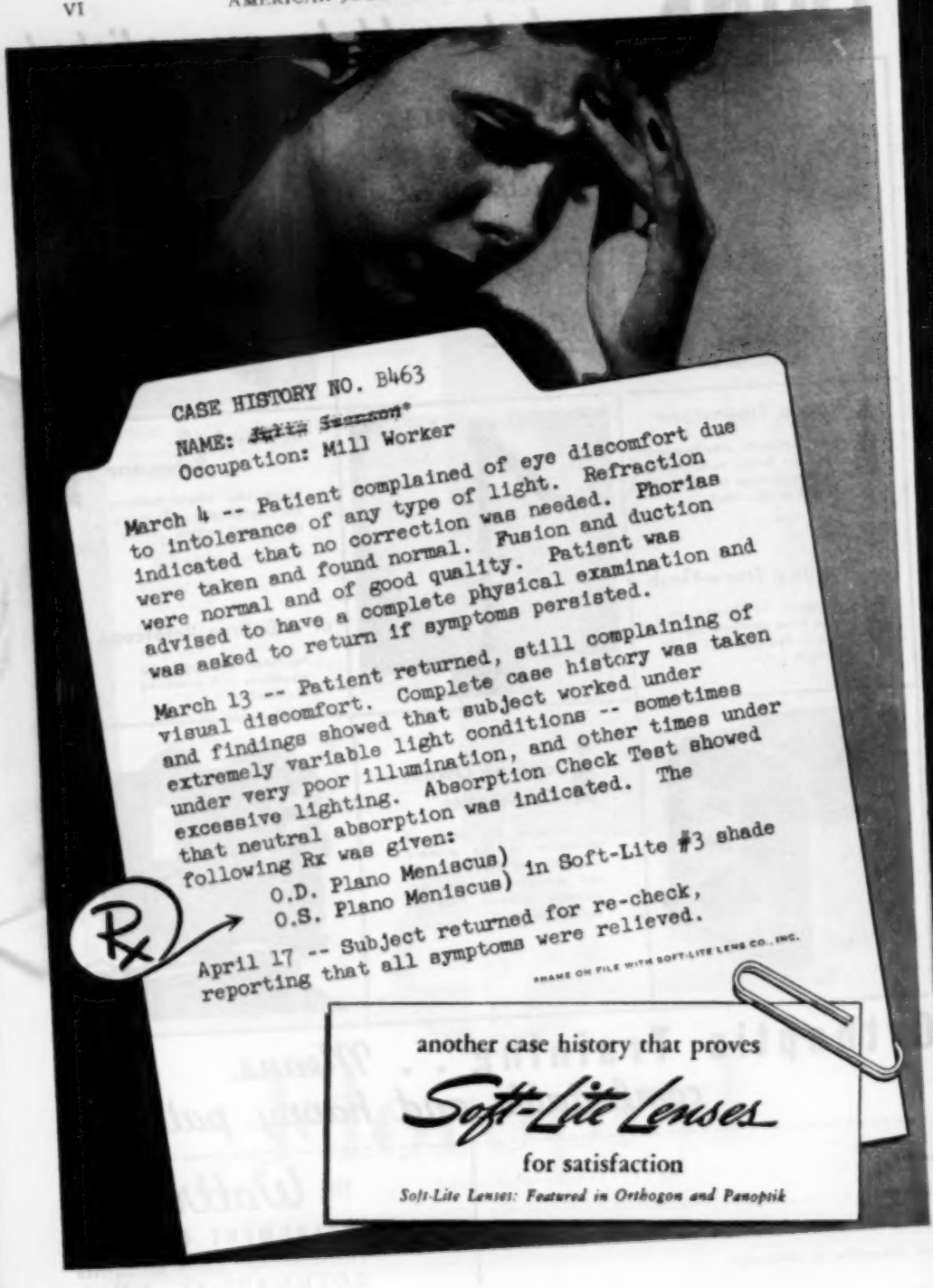
CASE HISTORY NO. B463
NAME: ~~Julia Seamon~~*
Occupation: Mill Worker
March 4 -- Patient complained of eye discomfort due to intolerance of any type of light. Refraction indicated that no correction was needed. Phorias were taken and found normal. Fusion and duction were normal and of good quality. Patient was advised to have a complete physical examination and was asked to return if symptoms persisted.
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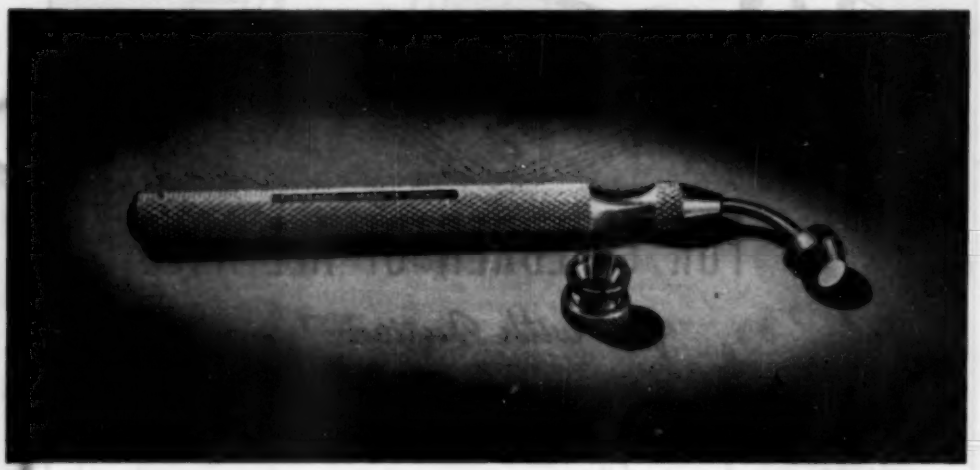

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References:

1. *Atkinson, W. S.: Arch. Ophth. 42:628 (Nov.) 1949.*
2. *Key, S. N., Jr., and Key, S. N.: Texas J. Med. 46:31 (Jan.) 1950.*
3. *Lebensohn, J. E.: Am. J. Ophth., This issue*

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The first case is Mr. D, a druggist, who required a very small distance correction and a +2.50 add for near. Mr. D's complaint was that while both the distance and the near visions were satisfactory, he could not see merchandise which was above eye level and on shelves, or read the labels on prescription bottles which were similarly located. Mr. D's problem was solved by giving him "baseball" trifocals.

In the "baseball" trifocal, the bottom segment is for reading, the central portion for distance and the upper segment is the intermediate. In the case of Mr. D the intermediate add was +1.25. The "baseball" trifocal is used for storekeepers, mail clerks, librarians and all others who need an above eye level intermediate segment.

The second case is Mr. W, an architect whose trouble was blue print reading. He complained that to see the far edges of a blue print he had to either back away and use the distance lens or get closer and use the reading lens, both of which methods were most annoying and unsatisfactory. Mr. W's problem was solved by giving him ultex trifocals.

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The two cases above illustrate the use of but two of the many trifocals available. It is well to know about all of them because the success of the fitting depends on the proper selection of the segment size and position. Drawings of different trifocals together with data on segment sizes and shapes will be sent you on request.

"IF IT'S A LENS PROBLEM, LET'S LOOK AT IT TOGETHER"

AMERICAN JOURNAL OF OPHTHALMOLOGY

SERIES 3 · VOLUME 33 · NUMBER 6 · JUNE, 1950

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ABSTRACTS

General pathology, bacteriology, immunology; Vegetative physiology, biochemistry, pharmacology, toxicology; Physiologic optics, refraction, color vision; Diagnosis and therapy; Ocular motility; Conjunctiva, cornea, sclera; Uvea, sympathetic disease, aqueous; Glaucoma and ocular tension; Crystalline lens; Retina and vitreous; Optic nerve and chiasm; Neuro-ophthalmology; Eyeball, orbit, sinuses; Eyelids, lacrimal apparatus. 992

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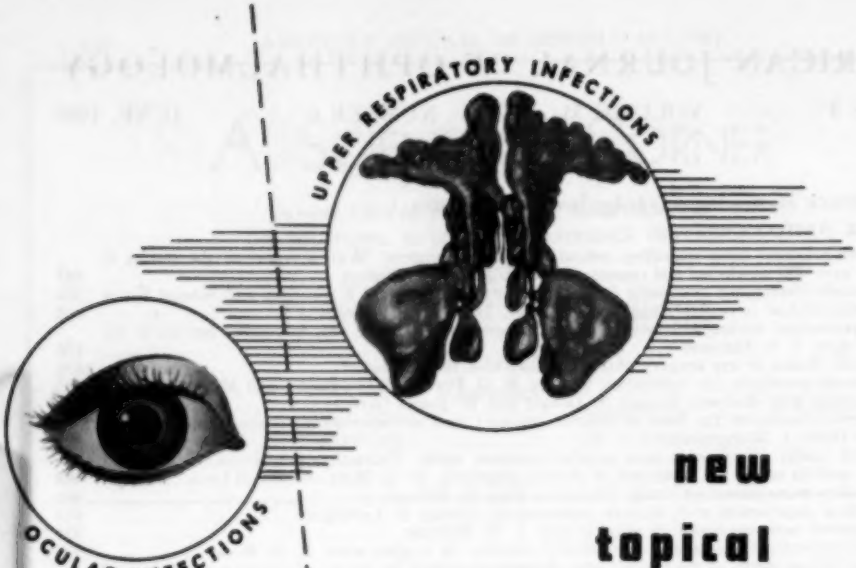

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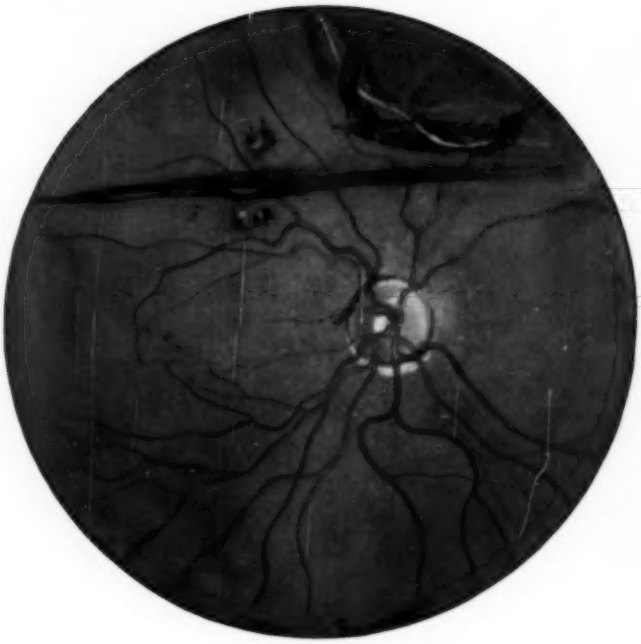

B

FIG. 1 (SHIPMAN). ARTIST'S DRAWING OF ONE OF THE CASES HEREIN PRESENTED. IT IS TYPICAL OF THE AVERAGE CASE. (A) APPEARANCE OF THE FUNDUS BEFORE OPERATION. THERE ARE TWO TEARS, CLOSE TOGETHER, UP AND TO THE RIGHT. (B) APPEARANCE OF THE SAME FUNDUS THREE MONTHS AFTER OPERATION.

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 33 JUNE, 1950 NUMBER 6

SOME PRACTICAL FACTS REGARDING RETINAL DETACHMENT SURGERY*

WITH A REPORT OF THE RESULTS IN OVER 400 UNSELECTED AND CONSECUTIVE CASES

JAMES S. SHIPMAN, M.D.
Philadelphia, Pennsylvania

Any discussion of retinal detachment surgery must include such names as Gonin, Lindner, Guist, Safar, Weve, Arruga, and Walker. Many others could be mentioned. I personally am grateful to the late Dr. B. F. Baer, Jr., who stimulated my interest in this subject, and gave me the opportunity to do an unusual amount of this work.

In this condition, which was formerly looked upon as hopeless, we can now consider a certain percentage of cases as curable. The percentage varies with the surgeon, the technique employed, the type of case done, and also with the standards or criteria used in determining a cure.

Krewson,[1] in 1939, gave a very excellent review and historical background of the development of retinal detachment surgery up to that time. Since then Pischel[2] has written extensively of his experiences. Kronfeld,[3] Thorpe,[4] and others have also contributed to the literature, but there have been no very radical changes in the surgical treatment of this condition. In recent years most of the contributions have been experiences with, or modifications of, previously described techniques.

Gradle,[5] in 1943, stated that the gaps in our knowledge of the surgical aspect of retinal detachment should be filled by individual clinical experiences only. I am in complete agreement with this thought and wish to report my surgical results and experience with a fairly large number of cases of retinal detachment; the volume of cases treated almost uniformly with one technique and by one surgeon would seem to justify this report.

THEORIES OF CAUSE OF RETINAL DETACHMENT

It might be well first to consider very briefly some of the theories which have been advanced as to the causes of retinal detachment:

1. Vogt[6] feels that degeneration of the retina, usually cystic, and occurring in association with "jactitation" of the vitreous scaffolding, plays the chief role in causing a retinal tear and a subsequent detachment. I have seen many eyes in which this explanation would seem very logical.

2. The traction theory for spontaneous detachment of the retina would seem to be one of the most logical and accepted theories today. According to this theory, vitreous plays a very major role as pointed out by Leber[7] and Gonin,[8] and later stressed by Lindner.[9]

3. Trauma of varying degrees and types is a precipitating cause of detachment in a certain number of cases.

4. Distention or stretching, as seen in myopia, is present too frequently to be coincidental.

* Read before the first Wills Hospital Conference, May, 1949.

5. Exudation, as in toxemia of pregnancy, choroidal hemorrhage, and inflammation.

6. Hypotony in aphakic eyes, especially when associated with the loss of vitreous or massive hemorrhage; also, recurrent hemorrhages with proliferating retinitis unquestionably predisposes an eye to retinal detachment.

From my experience I feel that any or all of these causes may play a part in bringing about a retinal detachment. Just which one is the most important seems to depend on a number of predisposing factors, too numerous to mention here.

TABLE 1

RESULTS OF OPERATIONS FOR RETINAL DETACHMENT

Retinal Detachments		
Total number of patients operated in this group		417
Total number of eyes operated in this group		431
Total number of operations performed in this group		629
Over-All Results		
Recovery	46.9%	
Improved	20.6%	
Total		67.5%
Failures		32.5%

Gradle and Snydaker[10] stated that the theories concerning idiopathic retinal detachment can be roughly divided into two classes: (1) Those in which the primary pathologic process is in the retina; and (2) those in which a pathologic condition of the vitreous plays a major role. Vogt and Weve[11] are the chief proponents of the first theory, and Gonin, Lindner, and Arruga[12] of the second.

SCOPE OF PRESENT REPORT

This report covers over 400 unselected and consecutive cases of retinal detachment operated by me over a period of 16 years, January, 1933, to January, 1949. The first 44 of these cases were operated either by me or by the late Dr. B. F. Baer, Jr., whom I assisted. These cases have been reported elsewhere.[13] The remaining cases were operated by me or under my supervision.

OPERATIVE TECHNIQUES

The earlier cases of this series were operated by various methods. The first few were done with the actual cautery as advocated by Gonin. However, we were unsuccessful with this method and soon changed to the method used by Weve with which the results were not much better. We also employed the Safar[14] nails and later the Larsson[15] ball electrode for surface coagulation in a few cases.

In at least five cases we followed the technique of Lindner and Guist,[16] which consisted of multiple trephining of the sclera over the area of the detachment and near the tear, if possible. The areas of the exposed choroid were then touched with five-percent potassium hydroxide. Of this group one case, occurring in a high myope, had a very successful result. After this we began to use the Walker[17] micropins and later the Lacarrere electrode, or the modification of this by Unsworth and Larkin,[18] and finally a combination of the two, as will be described later. Approximately 400 of the reported cases were done by the combined method.

RESULTS

In all, we have operated 629 times on 431 eyes of 417 patients, the results of which are classified as recoveries, improved cases, and failures. The recoveries were considered as those eyes in which the retina was completely reattached, with an enlargement of the field of vision, and with improvement of central vision to 6/21 or better, and this was maintained. The improved eyes were those in which the retina appeared to be reattached and the field of vision was enlarged, but central vision for one reason or another was not improved.

In our series of 431 eyes operated, as shown in Table 1, there was a recovery or improvement in 67.5 percent of the cases (46.9 percent of these were complete recoveries, and 20.6 percent were improved). The remaining 32.5 percent of the eyes operated on were failures.

The over-all results proved to be best in those cases which were operated only once; 79.2 percent of these had recoveries or were improved; in those operated twice, the results were favorable in 51.5 percent; those operated three times, 36.2 percent; those operated four times, 62.0 percent; and, finally, in one case which was operated on five times there was a complete recovery.

These findings would indicate that the most favorable results are obtained after one operation. However, they would also tend to prove that the continued perseverance on the part of both the patient and the surgeon may many times be rewarded by success.

The cases were about equally divided between private and clinic patients, 52.5 percent of the former, and 47.5 percent of the latter. The over-all results were approximately 10 percent better in the private cases. The explanation for this, we feel, is due to the fact that the cases in the private group were better risks, and they were better able to follow out our postoperative regime.

Sex and Age

Of the entire group, there were 62.4 percent males and 37.6 percent females. The ages varied; there were 9.1 percent in the age group below 20 years, and 3.5 percent in the age group over 70 years. The largest age group was between 60 and 70 years; this was 25.2 percent. Between 50 and 60 years there were 23.2 percent, and 15.9 percent between 40 and 50 years. This age group is older than that reported by others. McKeown[19] found the greatest number of detachments to be in the decade between the age of 30 and 40 years.

Trauma

Trauma was found to be a definite factor in 19.6 percent of all cases. However, our results in the traumatic cases proved to be no better than in the nontraumatic cases. We feel that this was partially due to the fact that a large percentage of the traumatic cases were old, so far as the detachment was concerned, when we saw them. Some detachments were due to intraocular foreign bodies which had previously been extracted and, as a result of this, they had fibrous bands extending from the retina into the vitreous.

The right eye was operated in 53.4 percent of the cases and the left eye in 46.6 percent.

Refractive error

So far as possible from the available records, the refractive error of all patients in the group was determined, and myopia of some degree was found to be present in 78.8 percent of the cases. Of this group 51.5 percent had myopia of under four diopters;

TABLE 2

STATISTICAL STUDY OF CASES OF RETINAL DETACHMENT

Retinal Detachments			
Private	52.3%	Male	62.4%
Clinic	47.7%	Female	37.6%
Right eye	53.4%	Traumatic	19.6%
Left eye	46.6%	Nontraumatic	80.4%
Age Groups		**Known Refractive State**	
Under 20 years	9.1%	Low myopia	51.5%
20 to 30 years	13.3%	High myopia	27.3%
30 to 40 years	9.8%	Myopia total	78.8%
40 to 50 years	15.9%		
50 to 60 years	23.2%	Hyperopia	16.7%
60 to 70 years	25.2%	Mixed astigmatism	3.1%
70 years and up	3.5%	Emmetropia	1.2%

27.3 percent had more than four diopters. Hyperopia was present in 16.7 percent and mixed astigmatism in 3.1 percent. Emmetropia was present in only 1.2 percent of all the cases. See Table 2.

Holes and Tears

Retinal tears were definitely seen and localized in 50.0 percent of the entire group. It can be said that in the earlier cases the percentage was lower than this, and in the later cases it has been much higher. Certainly, the more one becomes experienced in looking for and recognizing retinal tears, the more one will find. The location of the tears found conformed closely to that reported by others. The largest number we found were present above and temporally, and most of the disinsertions were seen below.

Location of Detachment

The location of the detachment (table 3) was found below in more cases which indicates that the detachment is usually associated with and near the area of the tear, but when the detachment is below many times the tear is above. Gravity does seem to play a definite role in the extension and position of the detachment. Many cases were seen with the tear at or below the horizontal plane in which the detachment had remained fairly well limited for many months. With this thought in mind, we make it a habit to allow patients with inferior detachments out of bed sooner than those with superior detachments.

Duration

A study of the duration of the detachment (table 4) in the various cases revealed that the greatest number, 47.2 percent, were observed by us one day to two weeks after first occurring; 27.1 percent of the cases were seen 1 to 2 months after onset; 10.4 percent were seen 3 to 6 months later; 6.2 percent presented themselves for treatment six months to a year after they first noticed trouble with their vision; 7.0 percent came to us 1 to 3 years after they first had signs

TABLE 3

Location of Retinal Detachments and Tears

Location of Detachment	Percent	Location of Tears*	Percent
Inferior	21.2	Inferior	15.2
Inferior-temporal	11.7	Inferior-temporal	13.0
Inferior-nasal	2.7	Inferior-nasal	2.2
Superior	19.7	Superior	28.2
Superior-temporal	7.8	Superior-temporal	16.0
Superior-nasal	3.6	Superior-nasal	8.4
Temporal	13.0	Temporal	14.0
Nasal	2.7	Nasal	2.8
Complete	17.3		

* In 50 percent of all cases at least one tear or disinsertion was recorded as seen before operation. This percentage was much higher in the cases done in recent years.

TABLE 4

Statistical Study of Cases of Retinal Detachment

Duration (when first seen)	
1 day to 2 weeks	47.2%
1 month to 2 months	27.1%
3 months to 6 months	10.4%
6 months to 1 year	6.2%
1 year	5.9%
1 year to 3 years	1.2%
More than 3 years	1.4%

Bilateral Cases

Twenty percent of the cases without a history of trauma, old inflammation, or aphakia were, or became, bilateral. One eye was operated by me in 63.1 percent of these cases. Both eyes were operated by me in 36.9 percent of these cases.

Average Hospital Days	
Preoperative days	5
Postoperative days	32

of ocular trouble; and, finally, 1.4 percent of the cases were seen and operated by us when the detachment had been present for more than three years.

As one would expect, those cases which were seen and operated on early showed the highest percentage of recoveries. Surprisingly enough, however, several of those cases in which the detachments had been present for a year or more before operation showed a very definite improvement following surgery. Indeed, it is my feeling that if the macular region has not been detached and cystic degeneration, as pointed out by Reese,[20] has not started, one may expect a satisfactory result in a fair percentage of cases, even though the retina has been detached from six months to a year.

We had one striking example of this in a case which had a bilateral detachment. In one eye the detachment had been present for over a year, and in the other eye for only three months. The eye with the detachment of the shorter duration was first operated on but this was not successful. The other eye, with the detachment for the longer period of time, was then done and a complete reattachment of the retina with 6/21 vision was obtained.

Bilaterality

Of all the cases in this group, approximately 10 percent were bilateral. However, if the known traumatic and aphakic cases were excluded, and consideration is given only to the spontaneous or idiopathic detachments, the percentage of bilateral cases rises to 20 percent. This percentage would be even higher if one excludes those detachments seen in myopia of four diopters or more.

Our experience, therefore, suggests that, if a patient has a detachment in one eye without relation to trauma, an old area of chorioretinitis or other explainable cause, he or she is very likely to have a detachment develop in the other eye. This usually follows in 3 to 10 years.

In this group, the majority of the bilateral cases seen, 63.1 percent had lost one eye due to a previous detachment which had occurred before the era of detachment surgery, or had been unsuccessfully operated. It was in this type of case, where the patient had everything to gain and little to lose by repeated surgery, that we did two or more operations. In a smaller percentage of the bilateral cases, 36.9 percent, I operated one eye and later operated the other for the same type of spontaneous detachment.

In a few of the cases, detachments were present in both eyes when the patient was first seen by me. However, there were some who did not develop the detachment in the second eye until 5 to 6 years later. This usually occurred in the same location, and showed the same type of tear as in the first eye.

For this reason I feel that every detachment, unless there is some good explanation for it, should be considered as bilateral. Every effort should be made to save as much vision as possible, no matter how little. One never knows when the other eye will develop the same condition, and the operative results may be worse than in the first eye.

Hospital days

The average preoperative hospital days for the entire group of cases was five. The average postoperative hospital days for the entire group of cases, with the exception of a few bilateral cases that were operated during the same stay, was 32.

Tenotomy

In this series at least one rectus muscle was temporarily tenotomized in approximately 95 percent of the operations done. In no case was it necessary to do further muscle surgery later to relieve a tropia. I feel that a rectus muscle should be cut and the field of operation made as clear as possible, if one is to get the best results in detachment surgery.

Aphakia

Of the entire series, 65, or 15.1 percent of the cases were aphakic (table 5). The results obtained in this group showed 35.2 percent recoveries, 19.2 percent improvements, or a total of 54.4 percent successes; 45.6 percent resulted in failure. This compares very favorably with the reports given by others. Indeed, in our series, the over-all

TABLE 5

STUDY OF RETINAL DETACHMENTS IN APHAKIA

Aphakia		
65 cases		15.1%
Over-All Results		
Recovery	35.2%	
Improved	19.2%	
Total		54.4%
Failures		45.6%
Time Elapsing between Cataract Extraction and Detachment		
2 months		38.3%
6 months		19.0%
1 year		6.4%
More than 1 year		36.0%

results in aphakia were not much worse than in the nonaphakic cases.

The only explanation suggested is that these cases had less than the usual amount of vitreous loss and postoperative hemorrhage following the cataract extraction, which usually encourages the detachment and complicates the recovery. Certainly, from our experience with detachment of the retina in otherwise healthy aphakic eyes, we feel more hopeful for a satisfactory result than we formerly did.

Comment

The results of our experience in this entire series of cases would therefore seem to indicate that certain cases are more favorable than others.

A. Favorable

1. Recent or early detachments.
2. Cases in which only one tear is seen, which is not too large, and is localized fairly well forward.
3. Eyes which are emmetropic or have only a low refractive error and are healthy except for the detachment.
4. Eyes in which the macula is healthy and uninvolved by the detachment.
5. Eyes in which disinsertions are seen, and these are small and recent.
6. Eyes in which the detachment is flat, or settles down flat after rest in bed with the head turned in a favorable position.

B. Unfavorable

1. Old extensive detachments of six months or more duration; however, these are not always hopeless.
2. Eyes in which more than one tear is seen in different portions of the retina and when any large tear is seen.
3. Eyes with high myopia, especially when associated with a degenerated retina.
4. When the macula is involved by the detachment and later becomes cystic, as described by Reese.[29]
5. Eyes in which there is a large disinsertion, with the vitreous in contact with the choroid for a long period of time.
6. Bullous detachments which do not flatten out with bed rest, goggles, and so forth.
7. Eyes in which the vitreous is cloudy from inflammatory process or hemorrhage. However, the hemorrhage may absorb and a successful result may be obtained.
8. Hypotony when present for any reason.
9. Tumor or solid detachment. This should be diagnosed before operation which is then contraindicated. In our series, so far as we know, we operated on only one eye which we later found to have a tumor, and this necessitated enucleation.

Management

History

It is very important to learn exactly when and how the patient first noticed the visual impairment. One should be impressed by such complaints as "photopsia," "spots," "coal dust," "cobwebs," and so forth. These phenomena are due to the tearing of a small

retinal vessel at the time of the retinal tear, and this gives rise to a hemorrhage. A knowledge of the portion of the visual field first involved often helps to locate the position of the retinal tear. The patient should be questioned carefully about any trauma, not only to the eye but also to the head and body. Most patients forget about other injuries and think that the eye itself must suffer direct trauma.

Refractive error

The refractive error should be determined, if possible, and the visual acuity obtained with and without glasses.

Ophthalmoscopic examination

The ophthalmoscopic examination of both eyes should be made with the pupils dilated, and with a strong light. One should look for lens and vitreous opacities. The detachment should then be located and its appearance observed, noting whether it is flat or bullous, peripheral, central, localized, or extensive, smooth or undulating. Striae with pigment suggest that the detachment is of long duration.

Cystic formation may indicate previous trauma with Berlin's edema followed by cystic degeneration. This may be present in old arteriosclerotic patients. This type of cystic degeneration often occurs in young adults with otherwise healthy eyes, and with no apparent cause. Sometimes it is present in young patients as congenital solitary cysts which look like tumors. These may rupture and cause large peripheral tears. Large sacculated or bullous detachments below, one on each side with a sulcus between, should suggest the tear to be above.

Examine the entire fundus for tears or disinsertions. Tears are of various shapes, sizes and positions, occurring most commonly above and temporally, above and nasally, below and temporally, below and nasally. The tear is always present and should be looked for exhaustively since it is this that we must close if we are to cure the detachment. If the tear can be seen when the patient is first examined, it should be localized by the method of Stine[21] and its position recorded. If no tear is seen, tumor is more strongly suspected and this possibility should be considered. Indeed, this should be thought of in every case and its presence ruled out, if possible, before operating.

Transillumination

Transillumination should be done carefully and repeatedly. Fields with reduced illumination may reveal an impairment over a large area corresponding to the extent of the detachment. If an absolute scotoma for a smaller area with full illumination is found within this, it may correspond to a tumor.

Because a tear is not seen, operation for detachment is not necessarily doomed to failure. In such cases, the tear must be assumed to be well forward, and at least two rows of coagulation are made over the periphery where the detachment is localized. The tear may thereby be closed without the operator knowing it, and a successful result is frequently obtained.

Preparation and Hospitalization

The patient should be advised of the seriousness of the condition and the necessity for operation; also the possibilities of success, the length of time it will be necessary to remain in bed, the long postoperative regime, and the complete coöperation and confidence required.

Let the patient *make the decision* after he or she has the *facts*. Mention the possibility of detachment occurring in the other eye. In our experience, as stated previously, 20 percent of the spontaneous cases were bilateral. Indeed, 6/60 vision saved in the only remaining eye means a great deal more than one can imagine to a patient who would otherwise be blind.

The patient is sent to the optician for an accurate fitting of pinhole goggles, the openings of which need be no smaller than 3 mm. (fig. 1). If the openings are much smaller

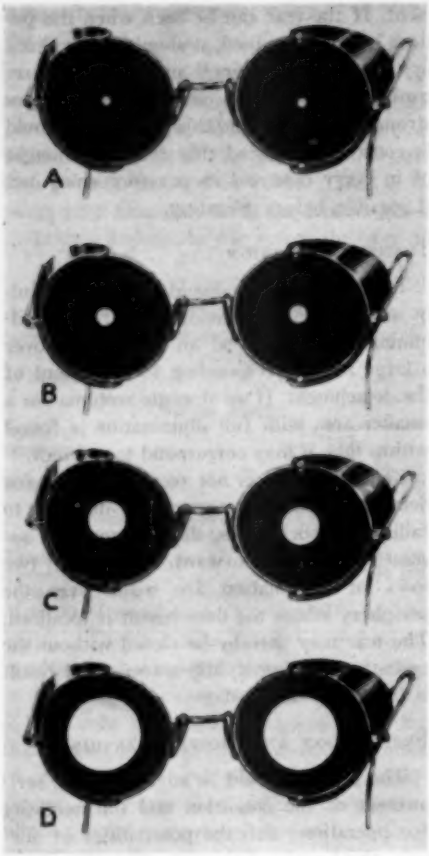

Fig. 1 (Shipman). (A) Goggles with 3-mm. openings worn from time of admission to hospital until operation. Also following removal of dressings two weeks later. (B) Goggles with 6-mm. openings, worn postoperatively on discharge from hospital. (C) Goggles with 12-mm. openings ordered on second visit to the office, two to three weeks after discharge from the hospital. (D) Goggles with large openings, 24 mm., ordered two to three weeks after wearing "C" goggles.

the patient will be very uncomfortable and will object.

Orders are written for the patient's admission to the hospital, where he or she is to be put to bed in the most favorable position to allow gravity to assist in the reduction and flattening of the detachment. Cultures are taken and antiseptic solutions used to keep the cul-de-sac clean. Goggles are ordered to be worn during the day, and bandages are placed on both eyes at night, before operation. I prefer to have patients wear goggles during the day rather than have the eyes bandaged constantly before operation. My reason for this will be stated later under complications.

A tear which cannot be seen before the patient is put to bed is, in many instances, located as the retina settles back in place. The pupil should be widely dilated to facilitate a good view of the periphery of the fundus. Indirect ophthalmoscopy sometimes is a help in examining the periphery. A complete and intensive search should be made until the tear is seen. A good strong light is essential. The A.O. giant or a similar ophthalmoscope is quite satisfactory. Above all, patience and perseverance on the part of the examiner must be had.

A rough drawing of the general appearance of the detached area should be made with the various levels of elevation, and the position and size of the tears noted and attached to the patient's chart.

Type of anesthesia for operation

In cases done for the first time, it has been our custom to use local anesthesia which consists of pontocaine (one percent) topically, and a retrobulbar injection of procaine (two percent) solution, 1.5 to 2.0 cc., containing two drops of adrenalin (1:1,000). This is injected through the skin of the lower lid rather than by the conjunctival route. Also, one cc. of the same solution is injected subconjunctivally over the area to be exposed. Sedatives are given to dull sufficiently the patient's sensitivity and awareness of the operative procedures. For subsequent operations, and in anxious or very nervous patients operated for the first time, general anesthesia is advisable. Formerly we used avertin, but now we use sodium pentothal intravenously in these cases, and it is most satisfactory.

TECHNIQUE OF OPERATION

The incision in the bulbar conjunctiva should be made well back from the limbus to obtain a large conjunctival flap. I feel that the position of this incision and the size of the conjunctival flap is very important. This incision is made all the way down to the sclera through Tenon's fascia, and traction sutures are placed in both the anterior and posterior lips of the conjunctival wound.

A serrefine clamp is attached to each of the sutures on the anterior edge of the conjunctiva, and with these the conjunctival flap can be pulled over the cornea. This keeps it covered and well protected while the operator is working. At any time he wishes, he can pull the flap back and obtain a clear view of the fundus with the ophthalmoscope.

The sutures in the posterior edge of the conjunctiva are pulled tight and fastened with mosquito hemostats to the sterile eye sheet. This provides good exposure and gets the posterior edge of the conjunctiva out of the way.

The desired rectus muscle is exposed and hitched with a cotton suture near each edge close to the scleral insertion. The tendon is then cut between these sutures and the insertion in the sclera. The muscle is laid back out of the way with a serrafine clamp on the two cotton sutures. All the bleeding is controlled and the sclera cleanly exposed and dried. A frost type of traction suture of No. 1 braided silk is then placed in the muscle stump and a hemostat is clamped on the ends of this.

The Arruga spoon is carefully inserted over the area where the retinal tear is suspected or has been seen. The vortex veins are looked for to be sure that they are not torn or injured. The position of these should be remembered to be—superior nasal, 7.0 mm.; superior temporal, 8.0 mm.; inferior nasal, 5.5 mm.; and inferior temporal, 6.0 mm. back of the equator of the sclera.

The assistant now holds the Arruga spoon in one hand and a small squint hook in the other. The operator holds the traction suture of the globe in one hand and rotates the eye in the desired position to afford a good ophthalmoscopic view of the suspected area of the retina. This, he examines with the ophthalmoscope held in the other hand, which is covered with a sterile muslin glove. The cornea is moistened with sterile water by the nurse or second assistant. After the exposed sclera is thoroughly dried, the operating room is darkened and the operator focuses the ophthalmoscope light on the retinal tear.

When he is certain of this, he tells the assistant to indentate the sclera with the squint hook over the area where he sees the light coming through. The assistant is warned not to mark the site of the transmitted light until the operator is definitely focused on the tear. The operator sees the indentation made with the squint hook and can direct the assistant to go a little further forward or back, and so forth.

When he is satisfied that the pressure is over the tear, the surgeon tells the assistant to mark this area with a toothpick or old cystitome, the end of which has been dipped into gentian violet. The tip of this is held in place until the lights are turned on and the exact location of the tip and the marking are seen. This method of localizing the retinal tear was demonstrated to us by Professor Lindner when he visited the Wills Hospital in 1935, and it has proved to be most satisfactory.

Having thus marked the exact location of the tear on the sclera, we then attempt to surround this with Walker micropins. However, we insert one as a guide and then examine again with the ophthalmoscope to see if it is accurately placed. Care is taken when the first few needles are inserted not to use too much current and penetrate the sclera and choroid too fast, since this may cause the loss of fluid and render the remainder of the operation very difficult.

With the ophthalmotherme, which has been the instrument used by us for the past 16 years, 65 to 90 ma. should be the maxi-

mum amount of current needed. If the tear is small and the detachment is fairly well localized, no more needles are used than necessary to surround the tear. However, if the detachment is extensive, we like to place 2 or 3 barrages of needles in addition to those inserted about the tear. These are placed about 2 to 3 mm. apart and left in place until after the Walker quill needle has been inserted. Every precaution is taken to avoid pulling or dislodging the needles and losing fluid.

After the desired number of pins are in place, a Walker quill needle is then inserted through the sclera and choroid directly over the most dependent portion of the detached area. This is pulled out quickly and a rather sudden evacuation of fluid is hoped for. The threads to all the regular Walker needles are then grasped and the needles are withdrawn together in order to encourage further a more rapid, even, and widely distributed outflow of subretinal fluid.

If we do not obtain a sufficient amount of fluid, and inspection with the ophthalmoscope still suggests the presence of fluid under the retina, a medicine dropper with the glass tip placed over various openings in the sclera is used to extract more fluid by rubber suction.

At this stage we employ the Lacarrere electrode. This is applied superficially to the sclera, with 25 to 30 ma. of current, between the Walker pin areas and especially to those areas underlying the recti muscles, which are not too accessible for application of the Walker pins. This procedure helps to squeeze out more fluid and, when the retina is nearer the choroid, one has a better chance to draw it to the coagulation without perforation or injury.

Care is taken in the procedure just described to avoid the vortex veins, whose position we have mentioned, as well as the macula which is located on the sclera, 29.2 mm. from the temporal limbus above the superior edge of the external rectus muscle, one mm. back and one mm. above the anterior or superior insertion of the inferior oblique muscle into the sclera. I also try to avoid the ciliary body which extends back seven mm. from the limbus, and I never coagulate further forward than the insertions of the rectus muscles.

Another careful ophthalmoscopic examination is now made and, if it is felt that the subretinal fluid is drained and the retina is fairly well back in place, the wound is closed.

The temporarily tenotomized muscle is first sutured back in place to the stump as near as it is possible to the original point of insertion, and these sutures are left buried. The conjunctiva is then closed with a running black silk suture and about one inch is left free at each end to allow for postoperative swelling and easy removal. Atropine ointment is instilled and both eyes are patched.

Postoperative Care

The patient is returned to bed after operation, and is again put in the same favorable position as before operation, in order to benefit from the influence of gravity on the settling of the detachment and on continued seepage of the subretinal fluid. The eye is dressed in 48 hours and every day thereafter, but no ophthalmoscopic examination is made for several days other than to see if a fundus reflex can be obtained. There is nothing to be gained by looking, and harm may be done. The conjunctival suture is removed at the end of one week. The bandages are removed at the end of two weeks, and pinhole goggles are allowed during the day.

The patient is permitted out of bed gradually at the end of three weeks. This depends on its being a superior or inferior detachment. He or she should be up at least a week before going home, with the openings in the goggles made twice the original size (six mm.). At this time the patient is warned against jars, bumps, stooping, and so forth. Instructions are given to continue wearing goggles during the day and to wear

bandages on both eyes at night; also, to sleep in the same position as while in the hospital, and to remain on one floor at home as much as possible.

Atropine (one percent) is ordered to be used once daily; and a wash of holocain, zinc, and boric acid to be used three times daily in the operated eye. A prescription for a saturated solution of potassium iodide is also ordered to be taken by mouth, five drops in water, three times daily. The patient is requested to return to the office in 10 days to two weeks after being discharged from the hospital, for examination which should include visual field studies and a rough manifest refraction. He or she is to be seen every two weeks after this for six weeks or more.

The size of the openings in the pinhole goggles should be doubled again after the second visit to the office. Modified goggles are ordered on the 3rd or 4th visit (fig. 2). These should have the proper distance and near correction for both eyes with the upper half blacked out with black enamel on the back surface of each lens, and detachable temple guards. These allow the patient to do a limited amount of work, but still limit ocular rotations to some extent. The black enamel is gradually removed and should all be off after six weeks' to two months' use. The temple guards are worn for another two months.

The atropine solution is discontinued as soon as the operated eye is quiet. The wash is continued as long as any secretion is present. The potassium iodide is continued for 5 to 6 months, if tolerated. If not tolerated, this should be taken alternate weeks. The patient might be allowed to return to some type of limited work at the end of six months, but should be warned against undue physical activity for another six months.

Complications

At time of surgery

1. Perforation of the sclera with needle at the time of the retrobulbar injection. This is more likely to occur in large myopic eyes with thin scleras.

2. Perforation of the sclera with scissors at the time of dissection. This is more likely in cases which have been previously operated, and are being reoperated over the same area.

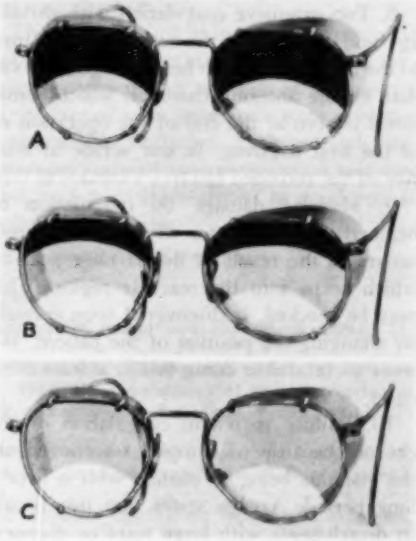

Fig. 2 (Shipman.) (A) Patient's glasses, which in this case are bifocals, with detachable temple guards, and with upper half of lenses blacked out with black enamel on back surface. These are usually ordered on the third or fourth visit to the office after operation. (B) Same as "A," except half of the black enamel has been removed, after patient has worn "A" for two to three weeks. (C) Same as "A" and "B" except that all of the black enamel has been removed, with the temple guards only remaining on the patient's glasses. This is ordered after the patient has worn "B" for two or three weeks. These temple guards should be worn for a period of another two months or more.

3. Hemorrhage at the time of retrobulbar injection.

4. Tearing or injury to a vortex vein.

5. Too much current used with the first few needles and the loss of fluid which gives rise to hypotony which makes it very difficult to insert more needles.

6. Injury to the corneal epithelium with

edema and opacification which causes an interference with an ophthalmoscopic view of the retina and tear.

7. Intraocular hemorrhage, due to the choroidal or retinal vessels being injured with the micropins.

8. Too extensive coagulation with shrinkage and burning of the sclera; also, injury to the ciliary body with hemorrhage and exudate in the anterior chamber, which sometimes is seen at the end of the operation or at the first dressing. In our series, at least five of the recorded failures were due to this.

9. Macular damage by coagulation or hemorrhage. The latter of these sometimes occurs as the result of hemorrhage near by which seeps into the macular region. This may be checked, if discovered soon enough, by changing the position of the patient. We were successful in doing this in at least three cases.

10. Failure to obtain coagulation of the choroid because of atrophy resulting from the vitreous being in contact with it over a long period. Arruga states that this occurs in detachments with large tears or disinsertions which have been present for a long time. This accounted for the failure in at least 10 of our cases.

LATER COMPLICATIONS

1. Marked reaction, more than usual, at first dressing. This may be due to cutting too many muscles, which may cause unnecessary trauma (one is usually sufficient). Infection may also be a cause for marked reaction.

2. Hazy cornea. This may be due to too much coagulation, or a corneal abrasion at the time of operation.

3. Anterior chamber filled with exudate, vitreous cloudy, and iridocyclitis. This is usually due to too much diathermy current.

4. Vitreous hemorrhage or exudate. The first may be due to injury to the retinal or choroidal vessels, and the second to excess in diathermy current.

5. Lens changes. These usually occur six months to three years later. Fifteen eyes in our series developed lens opacities of varying degree. None have required surgery as yet. Cataract formation has occurred in a sufficient number of cases in young people with a clear lens in the unoperated eye to make us feel that too much diathermy current was used, and this should be guarded against.

6. Infection of the conjunctival wound. This may result from an infected conjunctival sac or a contaminated suture. A few cases showed this.

7. Infection of muscle suture associated with granulation was quite common, and seemed to be due to the catgut suture. Cotton sutures seem to cause less reaction and granulation.

8. Redetachment when patient gets up. This, of course, is due to the fact that the coagulations have not made contact with the retina, or, if so, they are not strong enough. The patient should be gotten up very gradually, especially when he has been in bed with head low and feet up.

9. Vitreous hemorrhage when patient gets up too fast. This was not uncommon in our earlier cases. The absorption of this is sometimes hastened by typhoid vaccine injections and potassium iodides should be continued. The outcome is sometimes better than one would expect.

10. Cystic degeneration of the macular area, as described by Reese,[20] often appears after operation, due to the fact that the macula was involved by the detachment, before operation.

11. Vitreous opacities of some degree usually result, but they may be severe. These usually gradually absorb.

12. Proliferating retinitis with bands. Usually due to preëxisting pathologic conditions, especially diabetes. The prognosis is bad.

13. Filamentous keratitis. This has been a not infrequent complication, and in our experience it occurred just as often in the unoperated eye as in the operated eye. It oc-

curred in 21 patients, or in about five percent of our cases. In all cases it responded to cauterization with trichloracetic acid (15 percent). I feel that the long period of bandaging of both eyes has a definite influence on the development of this condition, and for this reason I prefer to use pinhole goggles before operation, rather than continuous bandages.

Conclusions

It is felt that the technique herein presented and the results obtained justify the continuance of surgery for the treatment of retinal detachment. We, as surgeons, should not be too quick to give up, and should offer the patient the benefit of surgery, if he is willing, even in those cases which might appear to be hopeless. One never knows what the outcome will be. We should consider each case as one with only one eye, or as a potentially bilateral detachment, and try to obtain the best possible vision in the eye under consideration.

The technique of this type of surgery is not difficult. The great trouble is for the surgeon to keep up his enthusiasm and spirits in the face of what sometimes seem to be unsurmountable obstacles. Patience and perseverance, as well as determination, are virtues, and they are essential to good retinal detachment surgery.

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PERIODIC ALTERNATING NYSTAGMUS IN FRIEDREICH'S ATAXIA*

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The occurrence of nystagmus, endocrine dysfunction, and mental disorder in Friedreich's ataxia is well known. The purpose of this report is to describe an unusual variety of nystagmus in a patient with this disease.

In periodic alternating nystagmus there is nystagmus on direct forward gaze—that is, in the primary position of the eyes. Over a period of minutes, there is spontaneous nystagmus to one side, then a period of midline standstill, and then spontaneous nystagmus to the opposite side. As the patient looks directly forward, there may be nystagmus to the right for one minute, a period without nystagmus for 10 seconds, then nystagmus to the left for one minute.

In the few cases of this condition which have been reported, the nystagmus has been both transient and persistent, and associated with disease of the vestibular system, the cochlear system, or the cerebellum. Buys[1] reported the case of a 49-year-old man with vertigo and oscillopia. There was diminution in hearing for high tones in the left ear, catarrhal inflammation of the nasopharynx, astigmatism, and moderate diminution of visual acuity. There was spontaneous nystagmus, alternating from left to right over a period of two minutes, with a five-second period of standstill interposed between the changes in direction. During the unidirectional phase of each cycle, the amplitude of the nystagmus gradually increased, then decreased. On Romberg testing, the patient fell if he were pushed from the side opposite the direction of the nystagmus. On walking blindfolded, he apparently deviated to the side opposite the direction of the nystagmus. Caloric and rotational tests, and neurologic examinations by Dr. Bremer were negative.

Kestenbaum[2] reported four cases of this condition. One patient showed periodic alternating nystagmus for a brief interval after operation for a cerebellar cyst. Another had luetic primary optic atrophy; his visual acuity was reduced to questionable light perception. He exhibited cycles of alternating nystagmus about six minutes in length.

Another patient, who had bilateral chronic adhesive otitis but normal labyrinthine reactions, showed a left nystagmus of 105 seconds' duration, a period of standstill for 15 seconds, and right nystagmus for 83 seconds. Eight years later, the periodic alternations were still present; however, the intervals were shorter and less regular. A fourth patient with similar ocular findings and ataxia gave a history of an operation on the left ear.

Ruttin[3] reported the case of a 44-year-old woman who had nystagmus for at least five years. The nystagmus was rotary, but alternated in direction from left to right over a period of several minutes. There was diminished bone conduction. Myopia and myelinated optic-nerve fibers were noted. Neurologic examination by Dr. von Econ-

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omo was negative. Van Rossem[4] reported a patient who had sustained a basal skull fracture 12 years previous to examination; he had periodic alternation in the direction of nystagmus.

Cantele and Grahe[5] reported two cases in patients who had diminution of auditory acuity. In one, there was rotary nystagmus to the left for 103 seconds, a pause for 10 seconds, and rotary nystagmus to the right for 50 seconds. In the other, there also was alternating nystagmus which was spontaneous and rotary, but no rest period was noted between the changes in direction.

Case report

History. A. B., a 28-year-old man, was admitted to Bellevue Hospital after he consulted one of us (S. B.) because of unsteadiness and weakness of the legs for the past six years.

When he was aged eight years, the school nurse noticed that he had a squint. He was given spectacles shortly thereafter, and he has worn them since, although he sees equally well with or without the lenses. When he was 16 years of age, his mother noticed that his eyes made "jittery movements." When he was aged 22 years, he observed that his vision was blurred when he looked to either side. He could feel his eyes moving at such times. He found that by shaking his head he could make his eyes move when he looked directly forward.

In 1943, he was rejected by the Armed Forces because of a spastic gait. Since then he had had increasing difficulty in climbing stairs, finding that he tripped unless he held a hand rail firmly. Although he could walk a half mile on the level without fatigue, he became very tired if he had to walk upstairs several times in succession. During the past year he had been unable to "control" his legs well.

He stated that, although he was on his high school track team, after he reached the age of 20 years, he lost all desire to participate in active sports. However, he said that he had suffered no loss of his ability at shorthand or typing, and claimed that he had taken apart and reassembled a mimeograph machine while at work, nine months ago.

By the age of 20 years, his testicles had not yet descended and he had had no erections. He was given hormone treatment for the next two years, followed by a left orchidopexy. Since the operation, he had put on fat about the abdomen. He had never developed a beard, and his voice had always been high-pitched. During the past two years, male hormone therapy (oral) had been associated with the appearance of nocturnal emissions and the ability to have a voluntary ejaculation. He had never had sexual intercourse.

The patient had one generalized convulsion in childhood, said to have accompanied an attack of constipation. He had chickenpox, measles, and mumps in early childhood.

The patient's father died at the age of 57 years of coronary thrombosis. His mother and sister, aged 30 years, were said to be well and to have no congenital anomalies. A brother, aged 35 years, had congenital, bilateral pes cavus; he was five feet, six inches tall, and was well.

General physical examination revealed a white man who looked much younger than his age. He was six feet tall and weighed 184 pounds. There was bilateral pes cavus. The lower jaw was prominent. There was female distribution of hair and fat. The penis and scrotum were prepubertal in size and configuration, and a left-sided orchidopexy scar was noted. The prostate was not palpable. There was no scoliosis.

Examination of the eyes revealed nystagmus on lateral and vertical gaze. In addition, there was spontaneous nystagmus. As he looked directly forward, there was nystagmus to one side, then a period of midline standstill and then nystagmus to the opposite side. The pupils reacted to light and convergence. The fundi and central and peripheral

visual fields were normal. Examination of the ears was negative.

Gait was abnormal. The knees were elevated unusually high, but his heels struck the floor first. On standing with his eyes closed, he could easily be pushed backwards, but not sideways. There was some clumsiness on the finger-to-nose test and gross dystaxia on the heel-to-knee test. Successive movements of both hands and feet were slowly and inaccurately carried out. There was dysmetria in the arms and legs, more pronounced in the letter. Tone was diminished in the arms and increased in the lower extremities. Strength was decreased in the lower extremities. At times, lightninglike movements of the hands and forearms were noted.

The deep tendon reflexes were overactive and equal. The abdominal reflexes were present. There were bilateral Babinski toe signs, and ankle and patellar clonus.

Sensation was unimpaired; vibration sense and other modalities were intact.

His sensorium was clear. Obsessive trends were noted, as well as mild depression. He gave evidence of some sexual preoccupation. He was also interested in high-speed vehicles, powerful machinery, and mechanical equipment, which he would like to operate but could not. His score on the Bellevue-Wechsler test was 99. Tests of visuomotor coördination showed marked impairment. The Bender gestalt figures showed an organic pattern with visuomotor defect. The Rorschach test confirmed the findings of psychiatric interview and elicited considerable sexual preoccupation. There were also signs of intellectual deterioration. His handwriting was irregular and uneven.

Spinal fluid, serology, blood count, and urine examinations were negative. Nonprotein nitrogen was 29 and blood cholesterol 175. X-ray studies of the chest and skull were negative, except for mild prognathism. An air encephalogram revealed no air in the lateral ventricles. Basal metabolic rate was plus 7 percent and minus 23 percent on two separate occasions. Blood creatinine was 1.25 mg. percent; 24-hour urine specimen contained no creatine and 1.232 gm. of creatinine. Electroencephalogram showed a 10 per-second alpha pattern with occasional 6 to 7 per-second waves bitemporally and in the right posterior temporal region. The slow waves persisted on opening the eyes. Electrocardiogram was normal.

Clinical motion pictures were taken by Dr. Ernst Herz.

Special examinations

1. A series of successive cycles of periodic alternating nystagmus was timed, with the patient sitting erect and looking directly forward. On February 18, 1949, there was nystagmus to the right for 88 seconds, midline standstill 20 seconds, to the left 90 seconds, midline standstill 17 seconds, to the right 90 seconds, midline standstill 15 seconds, to the left 75 seconds. On March 17, 1949, there was nystagmus to the right for 87 seconds, midline standstill for 5 seconds, to the left 84 seconds, midline standstill 4 seconds, to the right 87 seconds, midline standstill 6 seconds, to the left 85 seconds, midline standstill 5 seconds, to the right 85 seconds.

The duration of the complete cycles varied from day to day, however, between 140 seconds and 6½ minutes. It should be emphasized that nystagmus on direct forward gaze was present only part of the time, while nystagmus on horizontal or vertical gaze could be elicited at any time.

2. The rate of the nystagmus varied between 82 and 144 per minute. The rhythm was irregular. The amplitude usually was low after a period of standstill, rose to a peak, then fell before another period of standstill.

3. Visual acuity was 20/20 in each eye during a period of standstill, but was 20/70 during the height of the primary position nystagmus.

4. The nystagmus persisted with the eyes closed, being palpable and visible through the closed lids and audible through the bell of a stethoscope. The periodic alternation of direction persisted in all positions of the head and body. The abnormal ocular movements were accentuated, or could be made manifest, by placing the head down between his knees or by vigorous shaking of his head.

5. He was rotated in the Bárány chair with his head inclined 30 degrees forward, stimulating the horizontal canals. Rotations to the right and left were followed by the usual nystagmus, pass pointing, and falling of the expected duration. With the head inclined 90 degrees toward the right shoulder and the frontal plane perpendicular to the floor, rotation produced the expected duration of vertical nystagmus.

6. Optokinetic drum testing was done with the patient erect and the drum directly in front of his eyes. During a period of ocular standstill, rotation of the striped drum to the right resulted in nystagmus to the left and rotation to the left resulted in nystagmus to the right. During spontaneous nystagmus to either side, however, by using a large optokinetic drum we were able to augment or abolish the nystagmus.

7. Caloric vestibular tests were done in the sitting position. Each ear was irrigated separately with cool water, with the head 60 degrees forward, stimulating the horizontal canals. Lateral nystagmus, pass pointing, and vertigo were of the normal direction and duration. Because of the length of time required to produce nystagmus by caloric stimulation, we were unable to correlate the alternations of spontaneous nystagmus with the nystagmus induced by this technique.

8. Sodium amytal (0.125 gm.) was injected intravenously during 1½ minutes. The nystagmus on direct forward gaze was unaffected by this procedure, his gait became more unsteady but his heel-to-knee ataxia diminished somewhat.

9. Hyoscine (0.6 mg.), or prostigmine (15 mg.), three times daily, did not affect the nystagmus.

10. The previous observations were concerned only with nystagmus in the horizontal plane on direct forward gaze. It will be recalled that this patient also showed nystagmus on horizontal and vertical gaze. The fast component of this gaze nystagmus was toward the direction of gaze. The amplitude increased with the lateral and vertical deviation.

During various phases in the alternating cycles of the spontaneous nystagmus, lateral gaze produced an algebraic addition or diminution of these two varieties of ocular movements. Thus, if there were spontaneous nystagmus to the right, gaze to the left would result in a diminution in the amplitude of the spontaneous nystagmus; furthermore, a point could be found at which there would be no nystagmus. Since the amplitude of the spontaneous nystagmus constantly varied, the points at which spontaneous nystagmus was abolished by this maneuver moved progressively across the horizontal plane.

Comment

This 28-year-old man showed signs of a congenital familial disorder involving nervous and endocrine systems, Friedreich's ataxia, and adiposogenital dystrophy. An unusual feature was the presence of periodic alternating nystagmus. The particular lesion underlying the nystagmus was difficult to localize, though it was probably in the brain stem. Vestibulocerebellar signs and pyramidal signs were present; occasional lightninglike movements of the upper extremities suggested the possibility of basal ganglion disease. The results of interview and psychologic tests suggested that there was a degree of diffuse cerebral deterioration.

In previous cases of this rare ocular disturbance, no autopsies have been reported. Clinical localization has implicated the vestibular complex and the cochlear system. A case of almost complete blindness with cen-

tral nervous system lues showed the same periodic nystagmic alternations as did our patient. The fact that our patient had good visual acuity would seem to rule out defective visual fixation mechanisms.

The reason for the remarkable alternation in direction of the primary spontaneous nystagmus remains speculative. In stimulation experiments on the brain stem of monkeys with the stereotaxic instrument, it is known that minute changes in the intensity or character of the electric current may cause a reversal of direction of movement of the eyes. Lorente de No[6] suggested that a reverberating electric circuit may account for the maintenance of nystagmus. Kubie's[7] concept of closed and open circuits may also be utilized in an attempt to explain the phenomena we describe.

Summary

A case of Friedreich's ataxia with adiposogenital dystrophy is herewith reported because of the associated finding of periodic alternating nystagmus. In addition to nystagmus on lateral and vertical gaze, there was nystagmus in the primary position of the eyes. As the patient looked directly forward, there was spontaneous nystagmus to one side, then a period without nystagmus in midposition, then spontaneous nystagmus to the opposite side. These cycles continued regularly over a period of months.

The duration of nystagmus to either side was approximately one minute, while the period of midline standstill lasted about 10 seconds. The rate of the nystagmus varied from 84 to 144 per minute and the rhythm was irregular. The amplitude was low following a period of standstill, attained a peak, and then diminished before the next period of standstill. The spontaneous nystagmus was made manifest or could be augmented by vigorously shaking the head.

Bárány chair, caloric vestibular tests, and optokinetic drum testing overcame the spontaneous nystagmus; these tests produced nystagmus with normal direction and duration. Visual acuity was 20/20 during a period of standstill and 20/70 during the phase of nystagmus to either side. Intravenous amytal or oral hyoscine and prostigmine did not affect the nystagmus of primary position.

We would suggest that, under abnormal conditions of disease within the brain stem, normally "closed circuits" may become "open," and reverberate in a repetitive alternating fashion so as to produce the syndrome of periodic alternating nystagmus.

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HYALURONIDASE IN OCULAR SURGERY AND THERAPY*

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An important constituent of the intercellular cement substance is the viscous polysaccharide, hyaluronic acid. This widespread biochemical entity was so named in 1934 when first isolated by Meyer and Palmer[1] from bovine vitreous, from which still comes the principal laboratory supply of this substance, the hyaluronate concentration of the vitreous in cattle being 3 to 4 times greater than in other animals. The enzyme, hyaluronidase, discovered by the same Meyer[2] in pneumococci, in 1936, was identified by Chain and Duthie[3] as the spreading factor first noted by Hoffman and Duran-Reynals[4] in testicular extracts. Although hyaluronidase also has a wide distribution in nature, bull testes continue to be the most practical powerful source of this enzyme.

Other agents with some spreading activity include ascorbic acid, glycerin, lecithin, and peptones. The detergents, however, simply lower surface tension but are not spreading factors. Unlike the mucolytic ferment, lysozyme, hyaluronidase is either a protein or closely associated with one, and is destroyed by pepsin and trypsin. It is freely soluble in water and dilute acids; insoluble in alcohol; inactivated by heat and ultraviolet radiation, but not by X ray.

Hyaluronidase activity is generally estimated by turbidity-reducing units (TRU), less often by viscosity-reducing units (VRU). When a protein, such as horse serum, is acidified to pH 4.2 and added to hyaluronate, a turbidity develops which does not occur, however, if the hyaluronate has been completely depolymerized by hyaluronidase. One turbidity-reducing unit is defined hence as the amount of enzyme per cc. which acting on 0.2 mg. hyaluronic acid at incubator temperature for 30 minutes reduces the turbidity in the test to that given by 0.1 mg. normally aggregated hyaluronic acid. One turbidity-reducing unit is approximately equal to 3.33 viscosity-reducing units.

ACTION AND PROPERTIES

Hyaluronic acid is an equimolar combination of glucuronic acid and N-acetylglucosamine, polymerized to large molecules having a molecular weight of several million. The gel formed is apparently not bound to protein. The chemical basis of the spreading reaction induced by hyaluronidase is the depolymerization of the hyaluronate through hydrolysis of its internal linkages. This decreases the viscosity of the gel and thus favors the spread of fluid through connective tissue.

The mechanical impulse of increased interstitial pressure either markedly accelerates or is prerequisite for hyaluronidase activity. The diffusion rate is proportionate to the amount of enzyme, but the extension greatly depends on the volume of the solution.[5] The local effect of hyaluronidase persists over 24 hours, but by 48 hours the tissue barrier is completely reformed.[6]

The enzyme has an exceedingly low systemic toxicity, and over 500 times the therapeutic dose has been injected experimentally without apparent effect on the blood pressure and respiration. No adverse reaction occurs if hyaluronidase is inadvertently injected into the blood stream as its enzymatic action is inhibited by blood serum. The purified preparation, now marketed in vials, has been sterilized by Seitz filtration and lyophilized—that is, all water was evaporated while in the frozen state. It is free from pyrogens, apparently nonallergenic, and compatible with certain bacteriostatic agents,

* From the Department of Ophthalmology, Northwestern University Medical School. Read before the Chicago Ophthalmological Society, February, 1940.

such as zephiran or phenyl mercuric nitrate. A stock solution of 150 or more turbidity-reducing units in 1.0 cc. diluent maintains its potency up to two weeks, especially if kept in the refrigerator.*

Aid to local anesthesia

Hyaluronidase is the most important adjuvant to local anesthesia since the introduction of epinephrine. Kirby, Eckenhoff, and Looby[7] first reported on this aspect at the Conference on Hyaluronidase sponsored by the New York Academy of Science, December 3, 1948. They announced that its spreading effect doubles the area of infiltration anesthesia and favors more certain success in nerve or ganglion block as an error of nearly one cm. is overcome by its use. In the triple combination of procaine-epinephrine-hyaluronidase, epinephrine prolongs the anesthesia and accentuates the spreading action by delaying the accelerated absorption that hyaluronidase effects, while hyaluronidase speeds the onset of anesthesia and increases the diffusion not only of procaine but of epinephrine as well.

Atkinson[8] and Keys[9] have been the first to publish their experiences in eye surgery with this anesthetic combination. To each five cc. of procaine solution was added 1 to 3 drops epinephrine (1:1,000) and 30 turbidity-reducing units of hyaluronidase. The value of massage in increasing diffusion after both infiltration and cone injection is emphasized. Atkinson found that the marked hypotony induced by retrobulbar injection increased the difficulty of cataract extraction, and in corneoscleral trephining often prevented the spontaneous prolapse of iris. Akinesia, as produced by either the O'Brien or van Lint method, was more rapid, more certain, and more profound.†

For the past year the triple combination has been used as the anesthetic agent by me or under my observation in over 100 diverse ocular operations. To a five-cc. vial containing five turbidity-reducing units of hyaluronidase was added 1 to 3 cc. of procaine-epinephrine solution.‡ In akinesia, muscle surgery, and enucleation the results were dramatic. The lid edema associated with the van Lint method is transient and negligible, while the akinesia is as effective as with the O'Brien technique. In either case the akinesia is so marked and prolonged that a lid-closure suture becomes mandatory. In operations combining surgery on the external and internal rectus muscles, the individual muscles were not anesthetized as an injection aimed at the ciliary ganglion proved entirely effective. Enucleations of all types were absolutely painless, even without the aid of systemic sedation. In tear-sac surgery, where an ischemic field is particularly wanted, the hyaluronidase exerted a spreading effect on the epinephrine which definitely facilitated the operation.

As is well known retrobulbar injection of procaine, or procaine with epinephrine, causes, besides ocular anesthesia and akinesia of the extraocular musculature, dilatation of the pupil, deepening of the anterior chamber, and hypotony. All these effects are intensified by the addition of hyaluronidase. In normal eyes the tension falls 6 to 9 mm. Hg in 5 to 10 minutes. Such marked hypotony is contra-

* Commercially available are Hydase (Wyeth, Inc.) and Diffusin (Ortho Pharmaceutical Corp.) in vials of 150 turbidity-reducing units, and Alidase (G. D. Searle & Co.) in vials the equivalent of 500 viscosity-reducing units. Hyronase (Schering Corp.), not yet released, is incorporated with a polypeptide gelatine derivative which acts as a stabilizer and conveniently adds to the bulk. In the presence of this stabilizer the vials show no loss of potency at room temperature for more than six months. The Schering Corporation kindly furnished a quantity of five turbidity-reducing-unit vials which proved most convenient for ocular surgery. I am indebted to all these manufacturers for generously supplying their products for clinical investigation.

† An additional paper, "Hyaluronidase: An aid to local anesthesia in ophthalmology," was presented by Harvey E. Thorpe before the Pan-American Association of Ophthalmology, March 31, 1950.

‡ Although any amount of hyaluronidase can be added without objection to the anesthetic solution, one turbidity-reducing unit per cc. is adequate.

indicated in operating uncomplicated cataract as the normal vitreous pressure aids the delivery of the lens.

Retrobulbar injection with hyaluronidase should likewise be omitted in those operations for glaucoma in which spontaneous prolapse of the iris is anticipated as in corneoscleral trephining, and the ab externo procedures of iridencleisis and iridectomy. A soft eye is also undesirable in retinal detachment, where a retrobulbar injection of procaine alone is consequently practiced. The negative vitreous pressure, however, is highly advantageous in removal of a dislocated lens or the membrane in after-cataract.

In office work, the addition of hyaluronidase avoids the distention which may disturb the surgeon during the operation and the patient afterward, as in chalazions, Ziegler cautery, electrolysis, lid suture, and so forth.

Therapeutic implications

1. Hyaluronidase, administered by instillation, even when combined with a wetting agent does not increase the absorption of drugs through the cornea over that of the wetting solution alone. Repeated instillations of 150 turbidity-reducing units per cc. in zephiran (1:3,000) did not hasten or intensify the action of miotics or mydriatics. This negative effect should have been expected, as hyaluronidase must be under pressure to act.

After cataract extraction, however, the lid closure, dressing, and mask contribute a certain amount of constant tension. In this instance, should vitreous have been lost at operation, the instillation of concentrated hyaluronidase promotes favorable wound healing through its action on the vitreous in the wound edges. In a case with disturbing loss of vitreous, a saline solution of 500 turbidity-reducing units per cc. was instilled on the day following operation and continued for four days. No disturbance of the cornea resulted. Healing was uneventful and the final corrected vision was 20/25, with +11.75D. sph. ⊃ + 1.5D. cyl. ax. 5°.

2. In muscle operations and enucleations, postoperative edema was less when the anesthetic solution contained hyaluronidase. Among the other patients was a muscle case in which postoperative chemosis was so marked as to cause eversion of the lower lid. After an injection of 150 turbidity-reducing units in the chemotic area, the edema promptly subsided and the lid returned to its normal position. In another patient, a persisting orbital edema after enucleation prevented insertion of prosthesis. Two daily retrobulbar injections of 150 turbidity-reducing units of hyaluronidase remedied the situation.

3. When retrobulbar injections are indicated to reduce the tension in glaucoma, the addition of hyaluronidase to the usual procaine-epinephrine solution markedly enhances the effect. In a typical case so treated the tension dropped from 46 to 27 mm. Hg in 15 minutes, and with DFP came down to 17 mm. Hg subsequently.

4. Subconjunctival injections of hyaluronidase, five turbidity-reducing units in 0.75 cc. procaine-epinephrine solution, have reduced the hypopyon associated with iritis and corneal ulcer—probably by increasing the permeability of the tissue barrier in the chamber angle. In a case if iritis glaucomatosa, which, through the error of a resident, had been treated with miotics, a hypopyon of 1.5 mm. was noted two days after atropine had been substituted. The hypopyon disappeared five minutes after the injection of hyaluronidase and did not subsequently recur.

In a patient with a corneal ulcer showing over two mm. of viscid hypopyon, the hypopyon was reduced to the limbus level four hours after hyaluronidase injection. When a delimiting keratotomy was then done, the remaining hypopyon welled up and flowed out, showing a complete loss of viscidity. Uneventful recovery followed.

In the treatment of corneal ulcer, if hyaluronidase is incorporated in the subconjunctival injections of penicillin, increased

penetration of penicillin would result and the reduced viscosity of the aqueous might forestall secondary glaucoma.

Hyaluronidase added to the 1-2-3 mixture (cocaine, five percent, one drop; atropine, one percent, two drops; epinephrine (1:1,000), three drops) and administered subconjunctivally released posterior synechias of one week's duration fully, and those of one month's duration partially. No effect, however, was observed on the artificial pupil obtained by a Wheeler incision.

In iritis glaucomatosa, treatment by subconjunctival injections of hyaluronidase is worthy of trial before resorting to paracentesis. In one case of persisting postoperative hyphemia, subconjunctival injection of five turbidity-reducing units hyaluronidase produced no change.

5. In inadequate filtering operations, the subconjunctival injection of hyaluronidase may increase the efficacy of drainage. In one case of iridencleisis ab externo in a colored woman, 150 turbidity-reducing units were thus injected with an apparently favorable effect. Subconjunctival injections of hyaluronidase, from 5 to 150 turbidity-reducing units, tried in absolute glaucoma, in juvenile glaucoma, and the cyclitis glaucomatosa of tuberculous uveitis, however, produced no change in tension.

6. Subconjunctival injections of hyaluronidase might improve corneal nutrition by increasing the permeability throughout the limbus. In a patient with endothelial dystrophy the cornea became clear in four hours with a subjective improvement of vision after a subconjunctival injection of five turbidity-reducing units of hyaluronidase, but the condition returned to its previous status the next day. Likewise, in a case of punctate keratitis, the pearly white spots became for two days after the injection grayish and lighter with a sensation of increased clarity. The transient improvement was followed by a permanent regression of an accompanying superficial pannus.

The tendency of subconjunctival injections of hyaluronidase to clear the cornea, though temporary, may occasionally permit a better study of the interior of the eye, as in a dystrophy following cataract extraction, where fundus details could be visualized through the clarified cornea within the hour. In lattice-type keratitis the result was less marked.

Pannus has been favorably affected in every case treated. A vascularized pannus, superficially resembling a salmon-patch and unchanged after three weeks of routine therapy, practically disappeared the day following a subconjunctival injection of "Hyronase." Another case of similar character responded likewise. Small pterygiums were also apparently benefited. The remarkable effect on pannus may be due to the polypeptide supplement in the preparation used then (Hyronase). The polypeptide apparently has an irritant action since severe after-pain follows subconjunctival injections of Hyronase which does not occur when pure hyaluronidase is used. In the experimental irrigation of the anterior chamber with Hyronase,[13] the adverse effects reported would seem to be caused more probably by the irritant polypeptide than by the hyaluronidase.

In the corneal transplant operation a preliminary subconjunctival injection of hyaluronidase may possibly help in improving the nutrition of the graft.

7. In thyrotropic exophthalmos a myxedematous process has been considered present and the condition might be favorably affected by retrobulbar injections of hyaluronidase, followed by deep massage. Preliminary work indicates that large doses (150 to 250 turbidity-reducing units) in two cc. or more of procaine-epinephrine solution repeated daily or every other day will be required. In early cases such treatment may prevent subsequent irreversible fibrotic change.

When this paper was read, Dr. W. G. Hopkins had under observation at Billings Hospital a patient with thyrotropic exoph-

thalmos of such extreme degree that the lids could not close over the chemotic conjunctiva. A Naffziger operation had been performed but the immediate effect was to aggravate the chemosis and corneal ulceration subsequently developed in both eyes. At my suggestion, subconjunctival injections of hyaluronidase, 150 turbidity-reducing units, were administered. In the less-affected eye only one such treatment was given; in the other eye, there were three injections at 24-hour intervals. The response was immediate and permanent. With recession of the chemosis, the lids could close and the corneal ulcers healed. Since 1938, Ruedemann has had success in similar cases through the insertion of a rubber drain subconjunctivally in the inferior cul-de-sac from outer to inner canthus.

8. As the retrobulbar injection of hyaluronidase markedly increases the depth of the normal chamber, it may be tried in postoperative persistent loss of the anterior chamber either before or at the time air is injected.

Discussion

Certain considerations led Meyer[10] to assume an ocular circulation of hyaluronic acid and to suggest the hypothesis that the inhibition of hyaluronidase in the eye may be the cause of simple glaucoma. Hyaluronic acid is absent from the blood, and in the eye the principal site of production is probably the pigmentary epithelium. In cattle, the hyaluronate concentration of the vitreous is 0.52 mg. per gm. but that in the aqueous is 0.03 mg. per gm. and about 95 percent depolymerized, due to the hyaluronidase present in the iris, ciliary body and aqueous, the hyaluronidase content of the aqueous being 0.36 turbidity-reducing units per cc. Enzymatic depolymerization apparently allows hyaluronate to be constantly removed through the normal exit channels. Pirie[11] noted that after intravitreal injections of hyaluronidase in rabbits, the hyaluronate was completely depolymerized in four hours, but that after six weeks the vitreous had regained its normal state, thus indicating that the production of hyaluronic acid is a continuous process.

Though a circulation of hyaluronic acid seems established, there is otherwise little basis for Meyer's hypothesis. Among the agents that inhibit hyaluronidase are morphine, salicylates, antihistaminic drugs, and the steroid hormones activated by ACTH, but glaucoma has not been noted as a complication of their extensive or intensive use.*

Except for some diffuse injection and after pain, subconjunctival injections of hyaluronidase are well tolerated, but this does not hold for more direct applications to the ocular organ. Rabbit studies have shown that intracorneal injection of the enzyme results in vascularization of the cornea;[12] that irrigation of the anterior chamber produces clouding of the cornea, keratectasia, and iritis;[13] and that intravitreal injections cause a conspicuous inflammatory response from the inner membranes.[14]

4010 West Madison Street (24).

* This group of agents act by decreasing in varying degree the reactivity of the body. Consequently in iridocyclitis I have recently been administering an antihistaminic drug as an adjuvant to foreign-protein therapy with, I believe, a favorable response. The simultaneous administration of an oral antihistaminic drug with intravenous typhoid delays markedly the event of the chill but aids seemingly the therapeutic result. For hospitalized patients benadryl was selected because of its sedative action and gastric tolerance. Parke, Davis & Co. have kindly supplied a generous quantity of the drug for this purpose.

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EXPERIMENTAL STUDIES WITH PHYSIOLOGIC GLUE (AUTOGENOUS PLASMA PLUS THROMBIN) FOR USE IN THE EYES*

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This study, which was started in 1946, was at first concerned with the preparation of a concentration of thrombin which could be added to autogenous plasma to produce a fibrin coagulum and with observation of its effect in the eyes. Because of this coagulum's known adhesive and immediate fixation properties, it seemed feasible that it might also be employed in certain ocular operations in order to obtain more immediate fixation of the edges of a wound and also to obtain adhesion of the tissues. The coagulum would therefore act in two ways: (1) To serve as a framework or trestle between the edges of an open wound and (2) to provide a seal or adhesive for two tissue surfaces, thereby promoting and accelerating subsequent healing.

Coagulants have thus far been used to a very limited extent in ocular conditions. Busacca,[1] in 1938, employed a proprietary coagulant made from blood platelets and called "coagulen," mainly to arrest hemorrhage. This was injected into the abdominal wall usually on the day before operation. He found that it was especially valuable in checking hemorrhage in cataract extractions and other operations. But he also observed that, in his cataract operations with this procedure, an extremely dense coagulum was formed a minute or two after the keratotomy and, in some cases, it was necessary to remove this coagulum with a forceps. Although it was not employed for this purpose, Busacca also observed that the tenacity of the coagulum rendered the adhesion of a conjunctival flap more solid and facilitated the reformation of the anterior chamber. The action and possibilities of fibrin in this connection were not mentioned, however.

* Read before the first annual Wills Hospital Conference, May, 1949.

Nature of coagulum

For the purpose of this presentation, it is sufficient to state simply, that insoluble fibrin is formed by the addition of thrombin to fibrinogen which is normally present in the plasma. Coagulation of the blood results from the enzymelike action of thrombin on fibrinogen of the plasma to form fibrin. Although thrombin itself is not found in the circulating blood, it is present as an inactive precursor, prothrombin. When blood is shed, the prothrombin becomes activated in the presence of calcium ions, by thrombokinase and thromboplastin, which are set free when blood platelets disintegrate and when tissue cells are damaged. They are also present in some snake venoms.

Review of literature

Although we have found no reports in the ophthalmic literature regarding the use of an adhesive coagulum, a number of reports have been made by other surgeons who employed a fibrin coagulum for the purpose of uniting tissues and eliminating the use of sutures.

Young and Medawar[2] used plasma obtained from cockerels, which was fortified with the concentration of fibrinogen, in order to provide a fibrin suture for nerves. The cut sciatic nerve of the rabbit and also that of the dog could be joined by applying the liquid concentrated plasma which was allowed to clot around the stump. New fibers grew slightly faster across such a junction than across a silk sutured nerve.

Tarlow and Benjamin[3] employed the same principle for nerve union by adding chick embryo extract, which is a powerful clotting agent, to cockerel plasma in order to produce the fibrin clot. Later, however, they used mammalian, autologous plasma, since it was unnecessary to augment the fibrin content of such a clot, which was also found to produce less reaction.

The adhesive and fixing properties of fibrin coagulum were best described by Sano in 1943,[4] who employed a "new coagulum-contact method of skin grafting based on the principles of tissue culture." Sano realized, from her experience with tissue cultures, that new tissue would grow more readily and that the cut edges of tissue would heal better, if an immediate adhesion of the two edges or surfaces could be provided and maintained. Such a means would act as a bridge or framework for the gap which always exists between two cut edges or tissue surfaces. The close adhesion provided would facilitate the proliferation of cells during the process of healing.

To supply such a means for use with skin grafts, Sano used heparinized autogenous plasma which was painted on the recipient area, while the cellular extract of the patient's blood was painted on the under surface of the graft.

This cellular extract was obtained from the buffy coat, which is a thin layer containing leukocytes and a few erythrocytes and is present between the layer of red cells and plasma when the blood is centrifuged. Within a few minutes after the graft was applied, it was fastened in place by the coagulum which formed. The need for sutures and even retention dressing was eliminated, and vascularization of the graft usually followed in 48 hours.

This same principle was later employed successfully by Cronkite, Lozner and Deaver,[5] who used fibrinogen obtained from human plasma while thrombin was obtained principally from "hemostatic globulin" of the rabbit. Purified active preparations of thrombin became available in 1944.

Following this, Young and Favata[6] used a preparation of thrombin* which was added to a preparation of pooled plasma to provide adhesion and healing in various kinds of wounds. They found this very useful for suturing skin wounds, especially in young children, without the use of anesthesia. The resulting scars were even better than if stitches had been used. They were equally

* Supplied by the Upjohn Company.

successful with its use in skin grafts, and in two instances complete adhesion of the wound surfaces was obtained by the use of thrombin solution alone.

The same method for the fibrin fixation of skin grafts was also employed by Tidrick and Warner[7] at about the same time. These authors used purified bovine fibrinogen instead of human plasma and obtained a higher degree of fixation than with human plasma clot.

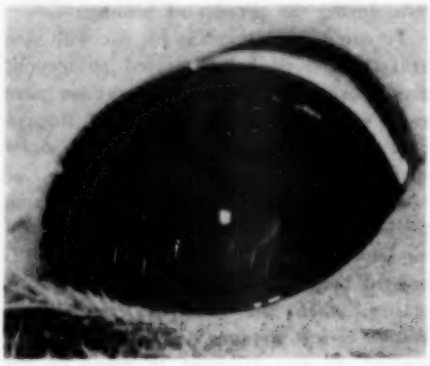

Fig. 1. (Tassman). Corneal transplant in rabbit's eye three weeks after operation.

In studying corneal healing and the adhesive power of aqueous fibrin in the rabbit, Brown and Nantz[8] demonstrated the strong clotting power of the rabbit aqueous after incision of the cornea. This was due to the high content of fibrinogen in the aqueous which united with the thrombin at the wound edges to produce a strong adhesion. Later, Katzin[9] fixed corneal transplants in rabbits by means of the aqueous fibrin formed in rabbits' eyes.

Rabbit experiments

We also observed and confirmed this experiment in rabbits. Under general anesthesia, a three-sided section about five-mm. wide was made through the cornea with a Graefe knife. The fourth side was left intact to act as a hinge for the flap. This flap was replaced and the eyelids permitted to remain open. A white fibrin coagulum formed in the anterior chamber and around the edges of the wound. These were sealed on the following day but the white coagulum could be observed for about one week. After two weeks, the cornea was completely healed with a thin white scar around the edges of the wound.

In another eye, a section of the cornea was removed in the same manner, under general anesthesia. After being replaced, the eyelids were permitted to remain open. After two days, the lens was protruding through the wound. This became tightly locked by the edges of the flap and could not be removed.

When the corneal section in another eye was completely removed, it was replaced and the edges covered with a drop of the rabbit's plasma plus two drops of prepared thrombin solution. The eyelids were sutured together and remained closed. A thick sticky clot formed between the eyelids and had to be removed with a forceps. After 48 hours, the lids were separated and the transplant was in place with a thick fibrinous clot around the edges and in the conjunctival sac. This was carefully cleansed and the lids were permitted to remain open. The transplant remained firmly fixed in place and clear after two weeks (fig. 1).

Stansbury and Wadsworth[10] in experimenting with procedures for corneal transplantation in rabbits encountered difficulty because of the rapid formation of fibrin when the anterior chamber was opened. In some of their cases this interfered with the proper placing of the sutures they employed and also fixation of the graft. They attributed their unsuccessful results to an inability to apply a pressure bandage to the rabbit's eye even with the application of lid sutures and noticed a postoperative ectasia with bulging of the cornea after removal of the sutures. It is true that ectasia of the cornea occurs in rabbits' eyes after the removal of

the lid sutures but this flattens out after a period of several weeks. We do not agree with these authors in their observation that a fibrin fixation of the cornea without sutures appears to be a most unlikely procedure.

The content of fibrinogen in the human aqueous, however, is almost negligible and therefore the latter has no adhesive property. Approximation of the wound edges in the human cornea is accelerated by the inhibition of fluid which occurs soon after injury. This is evidenced by the appearance of a grayish opacity around the edges of the wound. Furthermore, an early reduction in pressure will tend to approximate the edges more closely so that union and healing may occur more readily. The human aqueous itself, however, provides no adhesive power comparable to that which was found to be present in the rabbit's aqueous.

Brown and Nantz[11] conducted some further experiments in vitro to determine the adhesive power of the fibrinogen-thrombin reaction on the edges of isolated corneal segments under conditions simulating those occurring in man. They found that the mechanical adhesion increases progressively as a direct variant of the concentration of the fibrinogen. When plasma and platelets were added, the adhesive power of the fibrin was enhanced as much as 60 percent. This was considered to be significant inasmuch as the cornea is avascular and corneal wounds usually occur without bleeding.

In order to produce the same fibrin coagulum obtained previously from the blood fractions, we employed the autogenous plasma to which a few drops of a solution of sterile, purified thrombin was added. From the rabbit, blood was withdrawn into a five-cc. syringe which had been previously heparinized. This was immediately centrifuged to obtain the plasma.

The thrombin used was the preparation of Upjohn Company which is supplied as a powder contained in a vial to which a sufficient quantity of physiologic sodium-chloride solution can be added to obtain the required concentration. This preparation was preferred since the vial contains 1,000 units of the powder.

After a number of trials it was found that by adding two cc. of sterile isotonic sodium-chloride solution to the thrombin contained in the vial, this concentration (500 units: 1.0 cc.) proved to be most satisfactory for the purpose.

When three drops of the thrombin solution of different concentrations were added to 0.5 cc. of plasma in each of several test tubes, it was found that the rate of coagulation could be accelerated or retarded by increasing or decreasing the concentration of the thrombin. Others also showed that the speed of clot formation can be regulated as desired by changing the concentration of thrombin used.

With a concentration of 500 units in 1.0 cc., the reaction was almost immediate. A drop of plasma on a glass slide to which one or two drops of the thrombin solution is added, will gel almost immediately (figs. 2 and 3). A thick mucilaginouslike coagulum is formed which feels like glue and, when fresh, will stretch in the same sticky manner. In a test tube it becomes solid in about one minute and can no longer be poured.

Such a combination of autogenous plasma and thrombin solution was again employed in the eyes of rabits. Under general anesthesia, blood was withdrawn from the rabbit and plasma was obtained. The conjunctiva of the rabbit's eye was sectioned and a drop of plasma was placed under the flap. To this, two drops of thrombin solution containing 500 units in 1.0 cc. was added. The conjunctival flap was replaced, the edges approximated and held together for about one minute. The conjunctival wound was closed almost immediately and remained sealed. A few strands of fibrin adhered to the inner surfaces of the eyelids on the following day but there were practically no other signs of reaction.

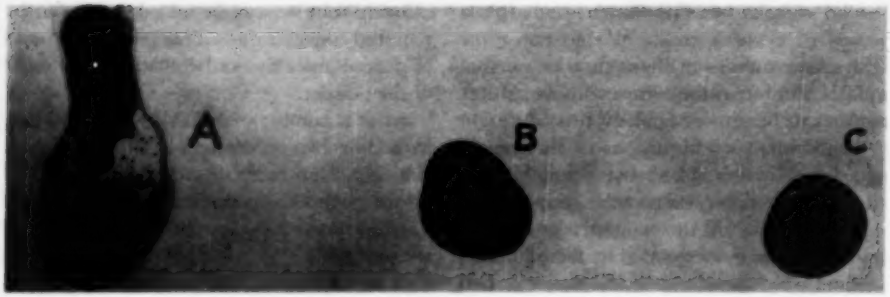

Fig. 2 (Tassman). (A) A drop of fresh plasma flows when placed on a glass slide. (B and C) A drop of fresh plasma plus two drops of thrombin are immediately fixed when placed on a glass slide.

Clinical use

The same results were obtained with clinical cases in which this preparation was employed in closing conjunctival flaps and in closing and sealing the conjunctiva following operations on the extraocular muscles without the use of sutures. In the latter cases, the results were especially satisfactory. It was also employed with excellent results in sealing the corneal section without the use of sutures after cataract extraction, and was also found to be useful in closing and sealing the separation of the wound which sometimes occurs as a later complication after cataract operations.

Preparation

On the morning of the operation, about 10 cc. of blood are withdrawn from the vein of the patient into a sterile syringe, the inside of which has been thoroughly coated with a solution of heparin. The blood is then transferred to a sterile test tube and sent to the laboratory where it is centrifuged. The plasma thus obtained is withdrawn into another sterile test tube and held until the time of operation.

In the operating room, about one cc. of the plasma is either poured into a small sterile medicine glass with a sterile dropper or it can be drawn up into a two-cc. syringe.

About two-cc. of sterile isotonic solution of sodium chloride is then added to 1,000 units of powdered white thrombin (Upjohn) which is contained in a sealed rubber-stoppered vial. The thrombin is dissolved by shaking and one cc. is then withdrawn with an ordinary sterile hypodermic needle into a small syringe. This is then placed with the plasma until required for use.

If desired, a preparation of pooled, purified plasma, supplied by Sharp and Dohme Company and containing a concentration of 0.3 gm. percent of fibrinogen, can also be

Fig. 3 (Tassman). The dry appearance of a drop of plasma plus two drops of thrombin after five minutes on a glass slide.

used instead of autogenous plasma. We have employed this preparation in one or two cases with good results. Small individual vials of lyophilized plasma, sufficient for one operation, are now being prepared by Sharp and Dohme Company, Glenolden, Pennsylvania.

Clinical application

In order to close the incised conjunctiva, one edge, which has been previously undermined, is drawn forward to approximate the other. This edge is held up with forceps by the assistant. The under surface and the rest of the field are dried with cotton applicators and one drop of plasma is dropped into the wound. Two or three drops of the thrombin solution are then added from the syringe and the edges of the conjunctiva are quickly approximated.

More than a drop of plasma is not necessary in most of the ocular procedures since the area is small and one drop will usually spread over the entire area. Moreover, there is less swelling because of a smaller accumulation of fluid, as the coagulum forms.

The conjunctiva should be held in place for about one minute while light, careful pressure is made with the tip of a dry cotton applicator. At the end of this time, the coagulum is formed under the conjunctiva and its smooth adhesion to the underlying tissue can be observed.

There should be no tension on the conjunctiva or other structures, if they are to adhere, since the fibrin coagulum will stretch while fresh, and its tensile strength is not very great. As it becomes dry, the coagulum contracts and draws the tissues more closely together.

The eye speculum is removed with extreme care to avoid scraping it over the eyeball. The eyelids are then carefully closed and the customary dressing can be applied.

The closure of the conjunctiva in this way eliminates the need for any sutures and is followed by practically no reaction. This is an added advantage especially in muscle operations on young children, by eliminating the need for the later removal of conjunctival sutures. Since the conjunctiva is a rather thin tissue, it adheres very quickly and tightly. See Figure 4.

Fig. 4 (Tassman). Appearance of the conjunctiva one week after an extraocular muscle operation.

In cataract operations, it is desirable if possible to obtain a small conjunctival flap, especially if the section is made with a Graefe knife. But regardless of the method employed for corneal section, the coagulum can be used to advantage when the operation is completed.

No matter how well the edges of the wound appear to be approximated, the thin coagulum formed over the length of the wound will provide added postoperative security by accelerating union and subsequent healing even without a corneoscleral suture.

When a suture is employed in order to provide security during the course of the operation, it can either be removed after the lens has been extracted or allowed to remain. There is no reason why the coagulum cannot be employed with a suture in order to provide added security.

On completion of the operation, a drop of plasma is carefully applied and permitted to

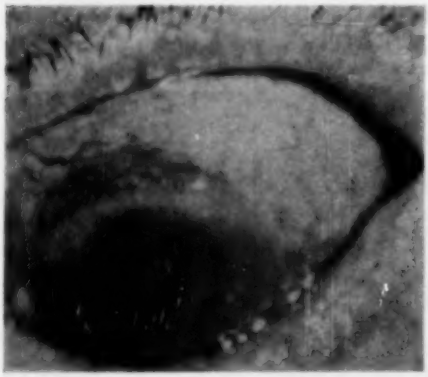

Fig. 5 (Tassman). Cataract section sealed with autogenous plasma plus thrombin.

spread over the edges of the wound at the limbus (fig. 5).

If there is a small conjunctival flap, the plasma is placed beneath it and two drops of the thrombin solution in the syringe are added immediately. Adhesion will occur very quickly but the eye should be permitted to remain open for about two minutes. During this time the fibrin coagulum becomes fixed and the wound closed.

The speculum is removed with great care to avoid touching the wound while the coagulum is still fresh. This danger is not so great after it has become dry.

A seal or covering has been provided for the wound which in most cases is followed by the reformation of the anterior chamber in 30 minutes. Moreover, additional postoperative security is obtained especially when dressings are changed and in the more apprehensive and difficult patients known as squeezers. The incidence of postoperative iris prolapse is also practically eliminated.

When incomplete wound closure occurs as a complication several days after cataract operation, even when a suture has been used, the application of the plasma-thrombin will provide a seal or bridge for the edges of the wound and thereby accelerate the union and subsequent healing.

Corneal lacerations can be treated in the same way. If the iris is prolapsed through the wound, it should first be excised and replaced. The addition of a drop of plasma and two drops of thrombin solution to the edges will seal the wound and greatly reduce the time of recovery. The approximation of the wound edges in this way aids the process of healing of the corneal epithelium. If the separation of the wound edges is not too great, the use of a conjunctival flap to cover the wound can be avoided while the size and appearance of resulting corneal scars should be greatly reduced.

In 1921, Gradle[12] described the complete disc keratoplasty of von Hipple, which was performed with a round corneal trephine. No sutures were used to fix and retain the transplant in position. This was said to become fixed in a few minutes by a plastic "exudate" which followed. The "exudate" received no further explanation. Fifty-four such cases by von Hipple were cited, in seven of which the corneal implants remained clear. Some of these were observed for as long as six years. The failure of the others to adhere was attributed principally to mechanical reasons.

Up to the present time, we have had the opportunity to employ this method in only three cases of corneal transplant in which the result was perfect so far as the "take" of the transplant was concerned. The corneal section was clear in each instance (fig. 6).

In one case there was a complication of anterior synechias but, although the visual result must be considered as uncertain, the

sealing of the corneal section and the "take" of the graft were all that could be desired. On the first dressing the transplant was clear, there was no swelling and the edges approximated.

The further use of this method is contemplated in these cases without the use of sutures since there is every reason to believe that the application of the fibrin coagulant to the edges of the corneal transplant will provide a more immediate and secure fixation than the use of sutures.*

The use of this method in the application of skin grafts to the eyelids or orbit, without the use of sutures or pressure dressings, is just as successful as its use has proven to be for skin grafts in other parts. In these cases, a sufficient amount of plasma is thinly spread over the recipient area while the thrombin solution is applied to cover the contact surface of the graft. The graft is then immediately placed in the desired position and permitted to remain uncovered for a few minutes. A firm adhesion will occur during this time and the dressings desired can then be applied.

Fig. 6 (Tassman). An eye in which a corneal transplant without sutures had been done four weeks earlier.

Fig. 7 (Tassman). An eye in which a corneal transplant without sutures had been done four weeks earlier.

We have used this method in one case of retinal detachment to provide an adhesion between the detached retina and the adjacent choroid. Although the operation was carefully performed, we were handicapped by an improvised and perhaps crude technique.

Two separate syringes with short needles were used for the injection of the plasma and thrombin solution as the subretinal fluid was released. The retina did become fixed in position and remained reattached while the patient was under observation. The vision in the affected eye returned to normal and the visual field was greatly improved.

Although this case was a success, the technique is still being improved and satisfactory needles are being provided to facilitate the injection of the two components to form a thin fibrin coagulum as the retina returns to come in contact with the choroid.

If the hole or tear is accurately localized and the injection carefully made around this area, it is reasonable to expect that the tear will be immediately sealed and the position of the reattached retina will be maintained. Moreover, the usual operating time, as well as the period of recovery, in these cases should be definitely shortened.

Conclusion

In conclusion, a method is presented for using a fibrin coagulum (plasma plus throm-

* Since this paper was submitted for publication, a total of 12 cases of keratoplasty have been performed by the use of this method, with successful take of the transplants.

bin) to provide an immediate fixation and adhesion of wound edges and tissue surfaces in ocular surgery.

As a preliminary report, it can be stated that this coagulum was found to be especially useful in closing the conjunctiva after surgery on the extraocular muscles, especially in children, without the use of sutures.

On completion of cataract operations, its use can eliminate the postoperative need for sutures. When applied to the edges of the wound after cataract operation, the wound becomes sealed immediately and the anterior chamber reformed in most cases in 30 minutes. The danger of postoperative iris prolapse is almost entirely removed. The wound remains closed and postoperative recovery is much safer and more rapid.

With incomplete closure of the wound sometimes occurring several days after cataract operation as well as with corneal lacerations, it will provide a seal to cover and fill in the wound, thereby accelerating union and healing.

Its use in applying skin grafts to the eyelids or about the orbit provides immediate fixation of the graft and final results equal to those reported with skin grafts in other parts.

The use of the plasma and thrombin to provide a fibrin fixation in cases of corneal transplant seems to offer an ideal means for obtaining the desired result in these cases.

In cases of retinal detachment, with an improved technique it should also prove to be an additional means for sealing the tear and providing immediate adhesion of the replaced retina to the choroid and maintaining this contact.

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Acknowledgement is made to Dr. Jacob Katz and Dr. Frank Cohen for their assistance with the preliminary laboratory and experimental work on rabbits' eyes.

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FIBRIN CLOSURE IN EYE SURGERY*

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As a consequence of studies which were made during the war in an attempt to find a material suitable for sealing traumatic lacerations and the incisions of keratoplasty, thus obviating the need for sutures, fibrin was found to have suitable adhesive power to seal the wound of incisions for cataract extraction. Brown and Nantz[1] have reported on the adhesive power of fibrin in the aqueous of rabbits and dogs and on isolated human corneal segments in vitro.

According to Parry and Laszlo,[2] the perfect form of wound repair must be a method which would obviate the need for sutures and yet help wounds to heal quickly and firmly. These authors used thrombin mainly because it was capable of reducing the bleeding time under the flap of a cataract incision. They felt that they managed to get well-sealed wounds in which the sealing effect was noticeable immediately after the operation and lasted through the danger period of rupture of the wound. The definite hemostatic power of thrombin alone might well be made of further use in ophthalmic surgery.

Since fibrin is not found in the aqueous of man, it would seem that by artificially producing fibrin there would be a better coaptation of the edges of the incision than can be accomplished by the use of sutures. Observations of the healing process show that, as the clot retracts, the wound edges are pulled together. The fibrosis which follows the fibrolysis of the fibrin mass is even, dense, and firm in two weeks.

The principal aim of fibrin closure is to prevent the complications incident to a leaky wound by providing an even and quick-healing incision. In addition, the hemostatic property of the thrombin should lessen hemorrhage into the anterior chamber. Furthermore, the traumatism caused by the introduction of corneoscleral sutures and the postoperative removal of them is averted. It is felt that a perfect closure will decrease the incidence of the dreaded postoperative complication of epithelial invasion of the anterior chamber.

There are many ingenious methods of inserting corneoscleral sutures which no doubt have decreased the incidence of iris prolapse, but no matter how well the sutures are placed there may be some gaping and puckering of the margins of the incision, which contributes to a wound leak. It is felt that the danger of iris prolapse is less with fibrin closure than it is when the wound is sutured.

Although epithelial invasion of the anterior chamber is a relatively rare postoperative complication of cataract extraction, it is a very serious one and anything the surgeon might do to prevent it should be a valuable addition to cataract surgery. As the diagnosis of postoperative complications becomes more accurate, more epithelial downgrowths probably will be noted.

Terry[3] stated that there are three ways in which epithelium could be introduced into the eye: (1) By implantation on a dull or ragged foreign body or instrument; (2) by a flap of conjunctiva or corneal tissue turned into the eye; and (3) by ingrowth of epithelium proliferating along the edges of a gaping wound or prolapsed tissue, or possibly along a corneal suture.

Theobald and Haas[4] report a proved histologic incidence of 0.11 percent. In 14 cases of epithelization examined histologically, they found that all of the cases showed evidence of delayed healing of the wound and they noted a striking clinical and pathologic resemblance between these cases and

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those produced experimentally by the inclusion of a conjunctival or corneal flap through a poorly healed corneal wound.

E. Treacher Collins[5] stated that, after corneal section for cataract extraction, a fibrinous coagulum occurs between the two stromal surfaces of the incised cornea. The corneal epithelium grows down into the wound until it is met by the fibrous tissue growing between the two stromal surfaces. As this fibrous tissue pushes forward, it gradually flattens out the ingrowing epithelial plug, and a smooth layer of corneal epithelium finally covers the wound. If the original coaptation of the lips of the corneal wound is not firm, instead of being stopped by the fibrin plug of tissue, the corneal epithelium continues to grow on into the anterior chamber forming a cyst of the anterior chamber. Closure with fibrin could prevent some of the mechanism of epithelial downgrowth from occurring.

Chandler,[6] in a discussion of the causes of failures in glaucoma surgery, states that hemorrhage may be a cause in the operation of iridectomy for acute glaucoma. In the majority of instances, serious hemorrhage during or after operation may be assumed to originate from the scleral vessels. In the trephining operation, to prevent persistent flat anterior chamber with separation of the choroid, meticulous, tight closure of the conjunctival wound with a mattress-type suture and crushing the edges of the wound together with forceps is advocated by him. The dangers of hemorrhage and wound leak may be lessened if the closure is made by the application of thrombin and plasma.

Technique of Preparation

In our work, the plasma was prepared for us by Dr. L. M. Tocantins in the following manner:

Collection of Plasma

Under sterile precautions, 45 cc. of blood is aspirated into a syringe containing 5.0 cc. of a sterile solution of 3.8-percent sodium citrate. The blood is mixed with the citrate in the syringe, then placed in sterile containers and centrifuged for 15 minutes at 2,000 r.p.m. The plasma is removed with sterile pipettes into a sterile tube. Three cc. lots of the plasma are then pipetted into five-cc. sterile ampules; these are stoppered with sterile cotton stoppers. Each ampule is then shell frozen in ethyl alcohol/carbon dioxide mixture. The plasmas are then dried from the frozen state in the lyophil apparatus.

Preparation of Plasma for Use

Whenever ready to use the plasma, 1.5 cc. of sterile water is added to the contents of one ampule; this will give a twice concentrated plasma solution which is then poured into a sterile medicine glass.

Into a separate, sterile medicine glass is poured a reconstituted solution of bovine thrombin (thrombin, 1,000 units, Upjohn). This is in the form of a powder and to obtain a strong solution 5.0 cc. of 0.85 percent NaCl is added.

Technique for Cataract Extraction

A limbus-based conjunctival flap is made around the upper half of the globe about four mm. from the limbus, as advocated by Theobald and Haas[4] (fig. 1). The incision is made at the limbus with a keratome—hollow ground with a concavity on the front surface so that the curvature of the incision will conform to that of the cornea. The front-surface-curved keratome should provide a better-healing wound than can be obtained if the incision is made with a flat-surface Jaeger keratome. The object of the incision should be to obtain a wound which is regularly curved throughout the upper half of the limbus, rather than one which is tangential in the upper part and curved in the lower part (fig. 2). The keratome which we use has a radius of curvature on the front surface of six mm., which approximates that of the cornea, and has a large base of 14 mm.

Beveling of the wound as advocated by Atkinson[7] (fig. 3) is as extreme as possible, and the wound is further enlarged with scissors to one half the circumference of the cornea. The beveling is continued by holding the scissors at an angle, and the amount of beveling is gradually decreased as the 180-degree meridian is approached. The beveled wound provides more surface for the fibrin to seal and thus lessens the chances for a leaking wound.

After the incision is completed, three traction sutures are placed in the superior margin of the conjunctiva. These are inserted at the 12-, 10-, and 2-o'clock positions. Their purpose is to facilitate the closure of the wound, and they are valuable if the conjunctiva retracts under the upper lid. The balance of the operation is carried out according to the particular choice of procedure of the surgeon.

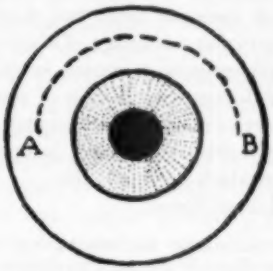

Fig. 1 (Town). The dotted line between A and B diagrammatically delineates the type of limbus-based flap advocated for the prevention of epithelial invasion of the anterior chamber following cataract extraction. (After Theobald and Haas.)

After the cataract has been extracted, one or two drops of the concentrated plasma solution are placed in the wound, first at the 12-o'clock position and then at intervals of about three mm. around the incision, so that it will be evenly distributed and in such a way that it penetrates into the incision. Im-

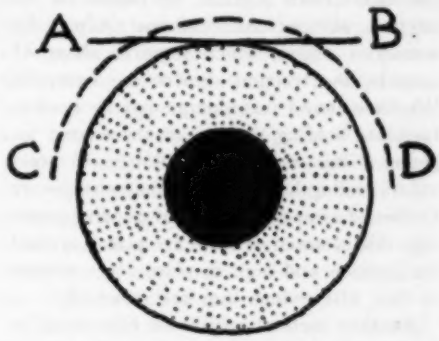

Fig. 2 (Town). The dotted line between C and D diagrammatically illustrates the curved limbal incision to promote an even-healing wound in cataract extraction. The solid line between A and B shows the usual tangential incision.

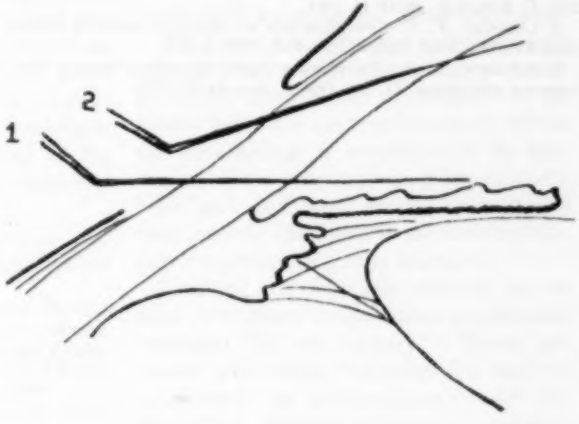

Fig. 3 (Town). (1) Usual angle of keratome incision. (2) Shows long bevel obtained when the point of the keratome is directed away from the iris and toward the apex of the cornea. (After Atkinson.)

mediately after, one drop of thrombin solution is added at each of these same intervals and care must be taken that the plasma already applied to the wound will not be displaced. This is accomplished by the use of a separate, sterile dropper.

The margins of the conjunctival incision are then drawn together by means of the traction sutures and forceps. After the wound is sealed, which requires about 45 seconds, the traction sutures are removed. We have found that clamps may be used to facilitate holding the lips of the wound together at this stage until the 45-second interval of sealing has elapsed. These clamps are fashioned after the manner of a spring paper clip. About seven of them are placed around the incision and kept in place for a minute or two, after which they are removed.

Another method which we have used to hold the lips of the incision together while the wound is being sealed is the placement of a running suture which is removed a few minutes after the application of the plasma-thrombin.

Conclusions

Sealing of ocular wounds with fibrin is secure, rapid, and produces an even-healing wound. The number of postoperative, leaky wounds is reduced, and the danger of hemorrhage, epithelial downgrowth, and iris prolapse may be lessened.

This technique of wound closure is applicable in cataract and glaucoma surgery, in keratoplasty, and in traumatic and plastic surgery. It does not seem that there could be any particular advantage of fibrin closure over catgut suturing in muscle surgery. We now have discontinued the use of sutures on the eye service at Jefferson Hospital and are using fibrin closure routinely in ophthalmic surgery in which it is applicable.

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Human plasma for this investigation has been supplied by Sharp & Dohme, Philadelphia.

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GENERAL ANESTHESIA FOR OPHTHALMIC SURGERY*

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General considerations

Since there is a paucity of information on anesthesia for eye surgery in the medical literature, it seems timely to present a discussion of such anesthesia. Some of the problems of the surgeon and anesthesiologist during ophthalmic intervention will be enumerated and the methods of anesthesia which have proved satisfactory to anesthesiologists and to ophthalmologists at Wesley Memorial Hospital will be reviewed. At the same time a survey of 316 general anesthesias given for ophthalmic surgery in the past three years will be reported.

The surgeon's requirements of anesthesia for eye surgery are essentially those of anesthesia for any surgical procedure with the addition that the patient must be especially quiet and tranquil and the eyeballs must be fixed in a central position. This results in certain problems for the anesthesiologist.

During eye surgery, the patient's head is in an upright and slightly extended position, thus encouraging the flow of mucus and saliva into the posterior pharynx and downward to induce reflex disturbances. The sterile draping prevents inspection of the eyes and of the skin and mucous membranes of the face. Likewise, the character and frequency of respiration are often obscured and can only be ascertained by palpation under the drapes. Finally, there is the obvious necessity for removal of the anesthesiologist and his equipment from the head of the table, and at the same time for maintenance of a controllable anesthetic.

In cases in which topical anesthesia, local infiltration, nerve-block, or combination of these methods will suffice for eye surgery they should be used.[1] By these methods, straining, retching, coughing, or vomiting, any of which will increase the intraocular pressure, can usually be avoided. These types of anesthesia require, primarily, a coöperative patient who is willing to remain conscious during the operation. These methods are not satisfactory for patients of the younger age group, with rare exceptions, and for certain older patients who are either uncoöperative, highly nervous, or who have other pathologic conditions which prevent them from being suitable subjects for the use of local anesthetic agents alone.

Since the introduction of sodium pentothal in 1935, this agent has been requested most frequently for eye surgery in many institutions and most of the literature devoted to ophthalmic anesthesia has been concerned with its use. The advantage of pentothal anesthesia is the removal of the anesthesiologist and his equipment from the surgeon's realm; nor is the surgeon restricted in his use of electrocoagulation, hot points, and epinephrine instillations in the eye. It is for these reasons that so many ophthalmologists advocate pentothal anesthesia regardless of the hazards accompanying its administration.

The increase of laryngeal and pharyngeal reflexes which usually accompanies pentothal anesthesia often makes maintenance of an airway difficult in any type of surgery. When this disadvantage is coupled with the hindrance of the drapes covering the patient's head, neck, and body, making the oral and nasal orifices inacessible to the anesthesiologist, the problem is greatly increased.

Coughing and especially sneezing are at times troublesome complications of pentothal anesthesia for eye surgery.[2,3] These are usually seen during induction and may be accompanied by laryngospasm. Falls[4] reported 147 consecutive cases of pentothal

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anesthesia for eye surgery with one death and several cases of apnea during and after operation. In his series the coughing and sneezing occurred in 9.52 percent of the cases. Often large doses of pentothal are necessary for resistant patients resulting in a long emergence period with increased nursing requirements.

Tribromethanol with amylene hydrate (avertin) may be given rectally as a basal anesthetic to be supplemented by other agents, or at times used without supplement. With this agent the difficulties of inaccessibility and lack of control of the airway are still present. There is also the problem of prolonged recovery time in the use of a basal anesthetic which may be of no consequence in many cases, but may be a complicating factor in others.

Endotracheal anesthesia

In the final analysis, the establishment and maintenance of a free airway, regardless of the agent or method of administration, present the greatest problem in general anesthesia for eye surgery. And the only certain method of assuring a patent airway in the unconscious patient is the use of an endotracheal catheter.

In ophthalmic operations in which the chambers of the eye are not opened, an increased intraocular pressure is not important, and endotracheal anesthesia is as valuable as in any other surgery of head or neck. Likewise, in those patients for whom general anesthesia becomes imperative regardless of an increased intraocular pressure this technique affords an added safety factor.

Endotracheal anesthesia has made rapid strides in recent years and is no longer looked upon as a major procedure. Intubation of the glottis is an essentially atraumatic procedure, and the incidence of major complications is very low, and, as Leigh[5] has pointed out, it should be possible to use it with impunity in children as well as in adults.

With an endotracheal catheter in place, the anesthesiologist can control the depth of anesthesia with ease and accuracy even though removed from the field of surgery, and reflex disturbances no longer present difficulties. Sudden and unannounced movements of the patient's head by the surgical team are to be avoided as these may cause straining in the light planes of anesthesia or even may dislodge the catheter from the glottis.

Gillespie[6] contends that the use of this technique overcomes the distaste which so many ophthalmologists have for inhalation anesthesia—a distaste chiefly inspired by the inconvenience of being hampered at every turn during the operation by the anesthesiologist and his equipment.

Anesthesia techniques used in this series

In this hospital, endotracheal anesthesia has been the accepted method for the majority of general anesthetic procedures in ophthalmic surgery lasting over 20 to 30 minutes. This method is used routinely in all eye-muscle surgery. We realize that our use of this procedure is not unique, but, since it has become an established anesthesia technique in these cases, it no longer causes the worry it did in the days when pharyngeal insufflation of ether by mouth hook, nasal catheter, nippled airway, or whatever method was convenient was used.

Throughout this series of cases, the children undergoing eye-muscle surgery were induced with vinethene and ether sequence until tracheal intubation was accomplished. The angle valve was used in the earlier cases. It was inserted into the end of the endotracheal tube and attached by rubber tubing to the ether-air vaporizer.

Since compressed air is available from wall valves in all the operating rooms, the source of ether vapor has been conveniently handled through a Richardson bottle. Thus the noise of a motor-driven blower and the danger of spark have been eliminated. Oxygen was added through a Y connection be-

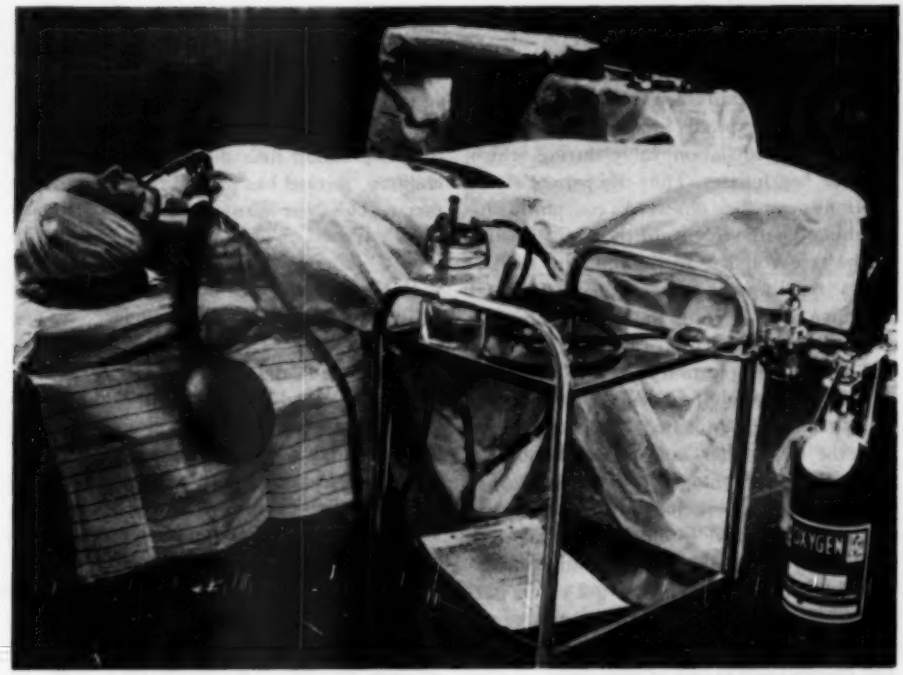

Fig. 1 (Parrish, Eason, and Karp). Anesthesia prepared for eye surgery, showing the endotracheal tube, the I.R.B. apparatus with the Richardson bottle and oxygen tank.

tween the angle valve and vaporizer. This satisfactory method permitted no rebreathing and gave rapid control of the ether administration.

However, a need was felt for a modification of the method—one in which the patient's respirations could be observed at all times and inflation of the lungs could be accomplished more rapidly and accurately than by closing the exhalation opening of the angle valve.

A light-weight apparatus with no resistance to breathing was designed.[7] The rubber midsection of an oronasal B.L.B. oxygen mask was used as the foundation. Four openings were left. A metal adapter was inserted into one of the outlets of the midsection, to which the endotracheal tube was attached. Two one-way valves were placed into two of the openings in such a manner that the direction of flow of the gases was through the inlet valve into the endotracheal catheter and out again through the outlet valve. A last opening, opposite the endotracheal tube, was closed, but could be opened for suctioning of the tracheobronchial tree.

A length of corrugated tubing was attached to the B.L.B. foundation, between it and the reservoir bag. The point of entrance of the anesthetic mixture was at the distal end of this corrugated tubing. For convenience, we have named this apparatus the I.R.B. apparatus (insufflation with reservoir bag).

The anesthetic mixture was furnished through a section of rubber tubing from a Richardson bottle. Oxygen was added by inserting a Y piece. During use, air flowing at a rate of 4 to 8 liters per minute into the

Richardson bottle is sufficient to maintain a full reservoir bag.

On inspiration the patient breathes the ether-air-oxygen mixture causing the bag to deflate. The expired mixture is released through the exhalation valve during which time the bag inflates. Thus the patient's respirations can be observed constantly by watching the movements of the bag. Pressure on the reservoir bag in rhythm with the patient's respirations will augment the tidal exchange and, if resuscitative measures are necessary, the exhalation valve can be closed and artificial respiration effected (fig. 1).

Most of the adult patients were induced with gas-ether, intubated, and maintained with the circle filter carbon-dioxide absorption technique. Pentothal sodium and curare enjoyed a short period of popularity as agents for tracheal intubation. Curare was used solely for the muscle relaxation necessary for intubation. Whether gas-ether, gas-curare, pentothal, or pentothal-curare are used for intubation is a matter for discussion and has no place in this presentation.

The short procedures were handled without intubation. In children, when little or no draping was necessary, open drop vinethene or vinethene-ether was used, occasionally followed by pharyngeal insufflation of ether vapor. In adults, pentothal sodium was given intravenously in a small number of cases. Early in the series a few patients received a basal narcosis of avertin, and were supplemented with local, regional block, or pentothal sodium.

Preanesthetic medication

The adult patients of this series were premedicated with morphine and scopolamine in the ratio of 25:1—the majority of them receiving a hypodermic injection of morphine (10 mg.) and scopolamine (0.4 mg.) 60 to 90 minutes before the beginning of anesthesia.

The inability of children to comprehend a hospital situation, and their relatively high basal metabolic rates increases their need for premedication. A system of preanesthetic sedation for children has been evolved using seconal, in relatively large doses, and atropine.* The barbiturates produce less respiratory depression than do the opiates and, in children, seconal has proved to be a satisfactory replacement for morphine.

Statistical study

We have reviewed the anesthetic records and charts of all the patients undergoing eye surgery with general anesthesia at Wesley Memorial Hospital during the period from October, 1945, to October, 1948. Our primary interest was in anesthesia for eye-muscle surgery and we, therefore, divided our series of patients into two groups: (1) Those having eye-muscle surgery and (2) those having all other types of eye surgery. The muscle surgery included all recession, resection, and tenotomy operations for the correction of various types of strabismus.

This separation of the cases is justifiable because of the type of surgery done in muscle work and the variations in anesthetic requirements, basically due to the longer duration of the surgery.

Chart 1 lists the various methods of anesthetic administration and subdivides these anesthetics according to age groups. The youngest patient was 18 months of age; 28.3 percent of the strabismus patients were aged

STRABISMUS OPERATIONS
TABULATION OF AGE AND METHOD

Method ↓	Age in years →												Total
	1 to 5		6 to 10		11 to 15		16 to 35		36 to 70				
	I	N	I	N	I	N	I	N	I	N			
Rectal and intravenous							2	1					3
Intravenous with or without local								4					4
Inhalation: I.P.B.	36		49		6		2						93
Inhalation: Angle piece	7		6										13
Inhalation: Carbon dioxide absorption			1		3		27		3				36
Inhalation: Open drop & insufflation				1									1
Total	43		56	1	19		31	5	3				150

I—Patients intubated N—Patients not intubated

Chart 1 (Parrish, Eason, and Karp). Various methods of anesthetic administration.

five years or younger; 37.5 percent of the patients in the muscle-surgery group were between 6 and 10 years of age; and 8.6 percent were in the 11- to 15-year age group.

Thus, we see that three fourths of the children who had strabismus operations were under 17 years of age, and over 65 percent were 10 years of age or less; 27.7 percent of the cases were in an age group older than 15 years.

Anesthesia in 95 cases of strabismus repair (62.5 percent) was maintained with the I.R.B. apparatus. The carbon-dioxide absorption circuit method of anesthesia administration was used 36 times (23.7 percent), mainly in adult patients.

Chart 2 concerns anesthesia for all the procedures other than muscle surgery. The number of procedures done in the children under five years of age without intubation were of short duration—3 to 30 minutes. The longer procedures in this series were, as a general rule, done with the endotracheal airway in place. A nine-year-old boy received an intravenous anesthetic without benefit of endotracheal intubation for a short electrocoagulation procedure.

The trachea was intubated in only 27.4

EYE SURGERY (Strabismus excluded)
TABULATION OF AGE AND METHODS

Method ⇩	Age in Years: 1 to 5 I	1 to 5 N	6 to 10 I	6 to 10 N	11 to 15 I	11 to 15 N	16 to 55 I	16 to 55 N	56 to 70 I	56 to 70 N	Over 70 I	Over 70 N	Total
Rectal								6		1			7
Rectal and intravenous					2			8		5		1	8
Intravenous with or without local			5	1	1		1	26	3	4		2	43
Inhalation: I.R.B.	5		7		1								13
Inhalation: Angle piece	3		1										4
Inhalation: Carbon dioxide absorption					2		14		10		1		27
Inhalation: Open drop & modification		40	1	23									64
Total	8	40	12	24	6		15	34	13	8	1	3	164

* I = Patients intubated N = Patients not intubated

Chart 2 (Parrish, Eason, and Karp). Various methods of anesthetic administration.

percent of this group; this is explained on the basis of duration of the surgery. To illustrate, the average duration of the endotracheal anesthetic in the 316 cases studied was 77 minutes; the average duration of the cases not intubated was 35 minutes.

Chart 3 shows the wide variety of agents used. The anesthetics have been listed under the principal agents employed. The miscellaneous group includes a few infrequently used combinations of inhalation agents. Because the majority of the patients were children, the ethers were the agents most widely used—in 188 cases or 60 percent. Fifty-three

EYE SURGERY
TABULATION OF ANESTHETIC AGENTS AND OPERATIVE PROCEDURE

Operation ⇩	Agents: Avertin & Local	Avertin & Pentothal	Cyclopropane Ether	Cyclopropane Curare	Pentothal	Pentothal Ether	Vinethene Ether	Vinethene	Nitrous Oxide, Ether	Miscellaneous	Total
Surgery for strabismus		3	12	4	1	4	109		8	11	152
Intraocular surgery	1		1		13		39	16	1	13	84
Enucleation or evisceration		6	5	5	8	6	1		1	3	35
Surgery on lacrymal app.			1		1		2	1	1		6
Surgery on eyelids			1		1	1	3		1		7
Surgery on cornea	4				4	2	2	2		1	15
Orbital tumors	1		1		1		1		1		5
Minor eye surgery					2		2	10			14
Total	6	9	21	7	31	13	159	29	13	28	316

Chart 3 (Parrish, Eason, and Karp). Variety of anesthetic agents used in eye surgery.

patients received pentothal sodium intravenously with or without supplement (16.7 percent).

The operative procedures are divided into general classes to facilitate inspection of the table. Under surgery on the lacrimal apparatus are included removal of accessory lacrimal gland, dilatation of the duct, and dacryocystorhinostomies. Surgery on the eyelid includes operations for ptosis and removal of chalazion. Corneal surgery includes paracentesis, keratectomy, and corneal transplants.

Lens operations such as cataract extraction, needling, and capsulectomy are listed as intraocular surgery, as is cyclodialysis, and surgery of the iris. Electrocoagulation includes all cases in which high frequency diathermy was used—primarily cyclodiathermy for detached retinas. The group titled minor procedures includes one removal of a foreign body, three removal of sutures, one incision and drainage of a small abscess, four funduscopic examinations in very small children, and five radium implantations.

Complications

In reviewing the complications of anesthesia in this series the sequelae of endotracheal intubation were noted in particular. These were obviously the result of the introduction into and presence of a relatively nonirritating foreign body in the mouth, pharynx, between the vocal cords and extending into the trachea.

Hoarseness and sore throat are the most frequent complications seen following intubation, and each was noted in seven, or 3.48 percent of the intubated cases. Six of the patients with sore throats had symptoms on the operative and first postoperative days; the other case lasted into the second postoperative day. Hoarseness on the operative day was present in two cases. There were two patients with hoarseness lasting into the first postoperative day and two other cases had symptoms which disappeared on the second postoperative day. One patient was hoarse for three days following surgery.

Of the intubated patients, 3.98 percent had increased mucus in the oropharynx and trachea after they were returned to bed. This necessitated suctioning on one or more occasions.

Four patients (1.99 percent of the intubated cases) expectorated blood-tinged mucus on the operative day, the result of slight trauma to the posterior pharyngeal wall, tongue, or epiglottis. In two patients of the group a tooth was loosened during laryngoscopy. However, no teeth were broken, and none were removed traumatically.

It is worth noting that four patients who were not intubated (3.48 percent) had respiratory depression after they returned to their rooms. These patients were not significantly depressed while in the operating room; but later their respiratory rates dropped to 10 per minute and there was slight cyanosis present. Two had had vinethene and ether as the anesthetic agents, and the others received pentothal, one with avertin as a basal agent.

Recently Donnelly and others[8] reported 100 intubations with postanesthetic indirect laryngoscopic examinations. This report leads one to expect more objective than subjective findings in these cases. Our report was based on subjective symptoms alone and in no instance did these symptoms prolong the patient's hospitalization. Furthermore, no treatment was required other than steam inhalations for hoarseness in three cases, and saline gargles in one patient with sore throat.

Conclusions

Endotracheal intubation of patients undergoing ophthalmic surgery is of distinct and marked value to the surgeon and the anesthesiologist. The patient's anesthetic course is made more stable by such a procedure, and the anesthesiologist's problems are lessened markedly in number and magnitude.

Endotracheal intubation in this series of cases has been an essentially atraumatic procedure, and the complications seen have been of minor consequence.

Summary

1. The anesthetic records and postoperative courses of 316 cases of ophthalmic surgery, covering a period of three years, have been reviewed and reported.

2. An apparatus is described which provides good control during continuous ether-air-oxygen insufflation anesthesia. It is applicable to patients of all age groups and physical conditions.

3. The complications seen following endotracheal intubation are discussed.

4. Endotracheal intubation may be undertaken almost routinely in ophthalmic surgery, with minimum danger to the patient and with results which are gratifying to both the surgeon and anesthesiologist.

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KERATITIS WITH DEAFNESS*

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The onset and course of this syndrome usually follows a characteristic pattern distinguished by bilateral photophobia, epiphora, ciliary injection, loss of vision, and ocular pain. These symptoms are followed in from one to several weeks by tinnitus, vertigo, and progressive loss of hearing. With onset of the nerve-type deafness the vestibular symptoms subside. Loss of hearing is usually permanent. The keratitis tends to remissions and exacerbations over a prolonged period. Evidence of syphilis is consistently negative.

Such a course was followed by the case reported by Mogan and Baumgartner[1] in 1934. On the possibility that the syndrome was produced by a "vasomotor disturbance" a bilateral superior cervical ganglionectomy was performed in their case after the syndrome had been present for 17 months. The patient was observed for one year thereafter, during which time he improved remarkably. The ocular symptoms subsided completely, improvement in hearing occurred, and only mild attacks of vertigo persisted.

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Cogan[2] reported four cases, three of which occurred in young women and one in a young man, a physician. All four followed a chronic course, with partial to complete deafness in three of the cases and recurrent symptoms of keratitis for from 4 to 17 months. In one case reported by Cogan the vestibulo-auditory symptoms preceded the ocular symptoms. A unilateral cervical sympathetic ganglionectomy was performed in one case without noticeable alteration in the course of the disease.

Cogan[3] has also observed two interesting variations of this syndrome, one with unilateral keratitis and bilateral deafness, and the other with recurrent, 30-percent eosinophilia, which was the only positive laboratory finding after exhaustive studies.

The following is a report of this unusual syndrome.

Case report

History. A 35-year-old white machinist was first seen by us on December 18, 1947, and gave the history of having had a rather severe upper respiratory infection during July of that year from which he apparently recovered completely over a period of six weeks. About November 15, 1947, he developed moderate blurring of vision with epiphora and marked ciliary and conjunctival injection. These symptoms were followed in 7 to 10 days by ataxia, severe vertigo, tinnitus, and bilateral loss of hearing. A few days prior to admission, nausea, vomiting, drowsiness, and generalized fatigue occurred. The only active therapy prior to admission had been parenteral vitamin B.

General physical and neurologic examinations were negative except for severe nerve-type deafness and these eye findings: Vision of the right eye was 6/15 and left eye was 6/9+1. Pronounced conjunctival and ciliary injection was in evidence along with diffuse, heavy, and almost nodular, flocculent bilateral corneal interstitial infiltration. There were no folds in Descemet's membrane and no keratic precipitates were noted. As nearly as could be determined, the anterior chambers were clear. The intraocular pressure was normal in each eye, and neither cornea stained with fluorescein. The pupils dilated only slightly with one-percent atropine. The fundi were negative.

Spinal-fluid manometrics and laboratory examination were normal. The report of December 22, 1947, is as follows: cell count = 1; globulin = 0; total protein = 41 mg.; Wassermann and Kahn tests were negative; colloidal gold was negative. Results of spinal-fluid examinations done on January 6, 1948, were negative.

Detailed blood counts and smears repeated over a period of three months after admission to the hospital were within normal limits as were bone-marrow studies. There has been no laboratory or historical evidence of syphilis in the patient or his family.

X-ray studies of chest and skull were normal, as was a pneumo-encephalogram done on February 13, 1948. The total volume of cerebrospinal fluid at that time was 140 cc. An electroencephalogram on March 2, 1948, was entirely devoid of normal alpha activity with low-voltage slow waves throughout the record. There was little change with hyperventilation. It was concluded that diffuse organic cerebral changes were present.

The patient failed to improve under symptomatic treatment and a high vitamin intake. Examination on January 8th disclosed complete absence of auditory and vestibular nerve function, bilaterally. From January 9th to 16th, he was treated with X rays to the head after the manner used to treat selected cases of encephalitis. This was followed by no improvement.

Treatment consisted of one-percent atropine sulfate in boric-acid solution in each eye twice daily, with holocain and epinephrine ointment three times daily. The pupils dilated only very slightly and lacrimation, photophobia, redness, and mild ocular pain persisted.

Operation. In view of the chronicity of the disease as noted in the literature, the failure of the patient to respond to symptomatic treatment, and the encouraging results in the case reported by Mogan and Baumgartner, a bilateral superior cervical ganglionectomy was performed. The right superior cervical ganglion was resected on January 20, 1948.

The operation and postoperative course were uneventful until January 24, 1948, when the patient had two generalized convulsions within a 15-minute interval. Another generalized convulsion occurred on January 25, 1948. The patient was given dilantin (1.5 gr., three times a day) and no more convulsions occurred.

On February 3, 1948, the left superior cervical ganglion was resected with an uneventful postoperative course. The ganglion was treated as noted under special studies.

Course. On February 9, 1948, the ocular symptoms were definitely decreased but labyrinthine and auditory functions remained absent.

The patient was discharged from the hospital on February 17, 1948, on a high vitamin intake. Holocain and epinephrine ointment was prescribed for symptomatic relief from the ocular symptoms. The general course since discharge has been one of improvement. There have been no convulsions even though all anticonvulsant medication has been discontinued for over six months. Photophobia and lacrimation have decreased and the patient is able to read a newspaper for short periods of time (fig. 1). There has been some improvement in hearing in that he is now able to hear loud noises such as "the radio turned on full volume or the baby beating on a tin cup." On March 22, 1948, the audiogram revealed "some air conduction hearing on the right."

Exacerbations of ocular symptoms have occurred on an average of one time per month and persisted for 2 to 3 days. However, each exacerbation has been successively less severe.

Fig. 1 (Donald and Gardner). (Left) photo of patient on February 17, 1948. Narrowing of fissures is due to orbicularis spasm resulting from photophobia. Epilation is result of X-ray therapy. (Right) photo taken July 3, 1948, five months after resection of superior cervical sympathetic ganglia.

Protein examination. In an effort to establish the etiologic factor a Tiselius protein examination of plasma was made on January 19, 1948. It disclosed the following results:

Total plasma proteins 8.03 gm./100 ml.
(Normal average 6.51, range 5.94-7.82 gm.)

Albumin 4.37 gm./100 ml.
(Normal average 4.09, range 3.72-5.11 gm.)

α gloubulin 0.60 gm./100 ml.
(Normal average 0.47, range 0.39-0.66 gm.)

β globulin 1.37 gm./100 ml.
(Normal average 0.81, range 0.65-1.07 gm.)

γ gloubulin 1.00 gm./100 ml.
(Normal average 0.77, range 0.60-0.91 gm.)

Fibrinogen 0.69 gm./100 ml.
(Normal average 0.33, range 0.16-0.48 gm.)

54.4 percent of total proteins
(Normal average 62.7, range 60.1-67.2 percent)

7.5 percent of total proteins
(Normal average 7.2, range 6.0-8.7 percent)

17.1 percent of total proteins
(Normal average 13.1, range 11.0-15.9 percent)

12.4 percent of total proteins
(Normal average 11.7, range 8.6-14.8 percent)

8.6 percent of total proteins
(Normal average 5.4, range 2.8-7.2 percent)

These results show only a slight deviation from the normal and cannot be considered pathologic. In infections there is usually a very significant increase in the alpha and gamma fractions.

Smears and cultures of the ocular secre-

tions revealed Staphylococcus albus and diphtheroid bacilli. Blood cultures were consistently negative. The patient's ocular secretions were injected subconjunctivally and introduced into the conjunctival sacs of rabbits without causing any observable abnormalities. Examination and culture of an ultracentrifuged specimen of the patient's cerebrospinal fluid were normal. No cells were detected and the cultures were sterile.

The patient's cerebrospinal fluid was injected into rabbits subconjunctivally and also by corneal scarification. No abnormal reactions occurred. The cerebrospinal fluid was also injected intracerebrally into one rat and six mice.

One mouse died on the third day after injection. Microscopic sections of the brain revealed an acute meningitis and blood-agar cultures were positive for B. coli. The rat died on the 10th day following injection. Cultures of the brain were negative. One half of the brain was emulsified in normal saline and portions were injected into six mice intracerebrally.

One mouse died on the fifth day following injection. Cultures of the brain were sterile and microscopic studies revealed an acute meningitis. One half of this brain was macerated and injected intracerebrally into six mice all of which remained healthy.

These studies, therefore, failed to demonstrate that the disease was communicable.

One half of the patient's left superior cervical ganglion was sectioned for microscopic study. It revealed questionable disturbance of the Nissl substance and shrinkage of some of the ganglion cells. It was felt that such changes might, quite possibly, be artefacts. Mogan and Baumgartner, however, reported similar findings. The remainder of the ganglion was emulsified in isotonic saline solution with the idea of releasing any intracellular virus. The emulsion was injected intracerebrally into eight mice and three rats. These animals remained healthy.

Summary

The case presented is one of interstitial keratitis of nonsyphilitic origin associated with vestibulo-auditory symptoms progressing to bilateral deafness. Cultures on various media and animal inoculations of the ocular exudate, spinal fluid, and emulsified superior cervical sympathetic ganglion did not demonstrate that the disease was communicable.

Bilateral superior cervical sympathetic ganglionectomy was not followed by demonstrable improvement. The electro-encephalographic changes and the occurrence of convulsions in this case indicate that the brain was involved in the disease process although the cerebrospinal fluid, pneumo-encephalogram and Tiselius protein studies were normal.

The cause of the disease remains obscure.

We are indebted to Dr. J. B. Hazard for his studies of the microscopic sections of this case.

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ELECTROCOAGULATION FOR CURE OF CHRONIC TEARING*

AND PERTINENT ADDED RELATED CONSIDERATIONS

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Electrocoagulation is being used more and more frequently, particularly in areas in which a surgical approach is difficult. The lacrimal apparatus represents such an area, and electrocoagulation has become the method of choice for treatment of many cases of chronic tearing.

The tear-conducting mechanism consists of (1) the eyelids, (2) puncta and canaliculi, (3) the tear sac and its prolongation downward into the nasolacrimal duct, as well as that portion of the nose into which the duct drains. Blockage located within these parts results in chronic tearing.

1. EYELIDS

The winking reflex, motive power of tear conduction, is reduced by facial muscle weakness. Slight weaknesses should be looked for first, for these, as well as greater degrees of lower eyelid muscle weakness, turn the lower punctum forward, away from contact with the lake of tears, and cause chronic tearing. Merely slitting such puncta backward seldom proves effective (case of Mr. C. H. S.[1]). A relaxed eyelid should be tightened to bring it close to the globe, thus turning the punctum backward to contact the tears. The scarring, which follows several electrocoagulating acupunctures along the margin of the lower eyelid, will readily produce this contact.

Technique. With topical anesthesia applied to the lower eyelid, eight acupunctures, spaced about four mm. apart, are made near the margin of the lid with a fine electrode. The indifferent electrode is in contact with the skin of the patient's back. The current should be strong enough to penetrate the conjunctiva and the tarsus, but not the skin.

Case 1. Mr. M. W., aged 60 years, was seen in April, 1947. He had had tearing of the right eye for eight years and, recently, tearing of the left eye. The right lower punctum was tightly contracted. The left eye transmitted a trace of fluorescein into the nose. Irrigation of both eyes into the nose was easily done.

Eight acupunctures were applied to each lower eyelid and, when cicatrization was complete, the eyelids were tightened. Fluorescein was then quickly transmitted from the eyes into the nose, slightly more rapidly from the left eye. The patient's appearance was improved by the removal of numerous wrinkles from the lower eyelids.

1A. ELECTROCOAGULATION OF LACRIMAL GLAND

When repair to promote tear conduction is difficult or impossible, electrocoagulation of the lacrimal glands to reduce tear formation may be beneficial.

Case 2. Marked eyelid muscle weakness occurs with varying degrees of facial paralysis. Mr. P. R., aged 43 years, was seen in November, 1947. He had suffered a complete right facial paralysis three years before, from which there was partial recovery. Since then his right eye teared.

No fluorescein was transmitted from the eye into the nose, but irrigation was easily done. His nose had previously been injured, with resultant blockage of the right nostril and right eustachian tube.

Seven acupunctures were made along the right lower lid. In addition, the palpebral portion of the lacrimal gland was coagulated at the exit of the lacrimal ductules (1,300 ma.‡). Treatment was not so thorough as it should have been, due to the patient's nervous condition.

Tearing ceased for three weeks while postoperative swelling of the lower lid was present, but it recurred in lesser degree with subsidence of the swelling. The orbital portion of the lacrimal gland should have been coagulated to reduce tear production further, in addition to repeating the treatment given.

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‡ Where amounts of current are specified, it is the reading on the milliammeter obtained when the active electrode is directly connected to the patient's inactive electrode (that is, without the patient in the circuit).

Complete facial paralysis, seen early, may be repaired by facial nerve grafting. If seen later, fascia-lata slings may be used. When such extensive procedures are contraindicated, palliative relief may be given by electrocoagulation. Repeated acupunctures of the paralyzed upper and lower lids elevate them. Tear secretion is diminished by electrocoagulative destruction of part of the lacrimal gland.

Case 3. Mr. J. S., aged 77 years, suffered a complete right facial paralysis following excision of a neoplasm of the right parotid gland in June, 1946. He was a patient in the Eye Clinic of the New York Post-Graduate Hospital. The upper and lower lids were stitched together at the outer canthus. This aggravated a feeling of weight pressing down on the right eye. Vision of the right eye was correctible to 20/25, the left eye to 20/40.

Under local anesthesia, eight acupunctures were made along the lower lid (700 ma.); the lacrimal ductules and the palpebral portion of the lacrimal gland of the overturned right upper lid were coagulated (1,000 ma.); and the orbital portion of the lacrimal gland was coagulated (1,500 ma.). Care was taken to avoid the lacrimal vessels that emerge at the orbital rim about 1.5 cm. medial to the frontomalar suture line which can be palpated.

To elevate the upper lid, 10 acupunctures were made (1,000 ma.) along the right upper lid margin penetrating the skin and tarsus while the upper lid was raised to its maximum extent to retract it from the globe. The palpebral and orbital portion of the lacrimal gland were recoagulated (1,350 ma.)

One month later, the patient stated that his right eye did not tear more than the left. He was able to read without annoyance of wiping away tears. Pressure on the upper part of the eye was relieved. This favorable result was maintained without further treatment. Two years later, regrowth of the neoplasm recurred despite radiation therapy.

An example of electrocoagulation of the lacrimal gland in youth as a contrast to its use in old age is given here.

Case 4. J. A., aged 17 years, was referred in October, 1944, for tearing of the right eye following an injury sustained in falling from a tree. Laceration of the right side of the forhead and the right upper eyelid near the inner canthus, as well as injury to the nose, hospitalized the patient for two weeks.

A stricture extended medially from the middle of the right lower canaliculus. This was opened and dilated. Electrocoagulation cut through the entire length of the nasolacrimal duct that was filled with scar tissue. Scar tissue reformed, especially at the neck of the tear sac. This was cut through a second and third time, but closed each time.

Scar tissue probably filled the tear sac. There was no mucous-membrane lining of the tear sac which could grow out to line the re-opened nasolacrimal duct and maintain its patency.

The ductules and the palpebral portion of the lacrimal gland were electrocoagulated (850 ma.) under local anesthesia. After injection of one cc. of 1.5-percent monocaine into the orbital portion of the lacrimal gland, it was coagulated (1,300 ma.). The duration of the current was short.

Two months later this procedure was repeated. There was a reduction in tearing which the patient estimated as about one third. Additional electrocoagulation could have reduced the tearing further, but the young man joined the armed forces.

Comment. The lesser result obtained in this young patient as compared with the aged man is probably due to several factors: (1) More active lacrimal gland in youth, with a greater water content, increasing the difficulty of electrocoagulation; (2) a larger part of the gland is hidden behind the concave inner wall of the frontal bone, and so not reached by the electrode.

A strong, stiff, bent electrode with a concavity toward its handle can reach such hidden parts of the gland much better than a straight needle such as Strebel[2] used (0.5 to 1.5 mm. thick and 3.5 cm., long; and 100 to 300 ma. for five seconds measured with the patient in the circuit). Current should be stopped before withdrawing the electrode.

In the future, in young persons with similar conditions, I intend to pass a horsehair through the canaliculus and down the reopened nasolacrimal duct where it will be left for 3 to 4 months to permit epithelization.

Tearing due to extensive conjunctival hypertrophy or tumor of the lower lid may be corrected by electrocoagulation.

2. Puncta and canaliculi

Puncta may be abnormally placed, closed, or blocked so that they do not contact the lake of tears. Puncta and/or canaliculi may be closed congenitally or by scar tissue formation after injury (mechanical, bacterial, chemical, or thermal). Commonly, they are blocked by chronic swelling or spasm. The lower punctum may face away from the globe, thus failing to contact the tears.

Several light acupunctures just posterior to the base will draw such puncta backward to contact the lake of tears when cicatrization is complete.

An imperforate punctum is opened with a sharp needle. The lower lid is pulled away from the direction of the penetrating needle for counterpressure as well as to straighten the bend of the canaliculis into which the needle is directed. A No.-2 Bowmann probe can then be passed. An indwelling horsehair permits epithelization in three weeks.

Part of or the entire length of a canaliculus may be closed by scar tissue. It may be blocked by a foreign body or by a tumor. Commonly it is blocked by chronic swelling and/or spasm. A canaliculus closed by scar tissue can be rechannelized.

If the punctum, as well as the canaliculus, is closed by scar tissue, the point selected for starting the perforation should be slightly closer to the globe than the site of the original punctum. Comparison with the position of the other eye, if normal, aids in correctly selecting the proper point.

A sharp needle in a holder is pushed through the scar tissue in the direction of the middle of the tear sac until it contacts the bony lacrimal fossa. The lower lid is pulled away from the direction of the needle while perforating. Increasingly larger dull-pointed needles, up to the caliber of a No.-6 Bowmann probe, dilate the puncture.

Immediately on withdrawing the largest dilating needle, a four cm. length of horsehair is inserted as far as possible into the newly formed canaliculus. The outer end of the horsehair is bent downward to contact the adjacent skin of the lower lid. Slightly above this point of contact, a 3- or 4-mm. counterpuncture into the skin is made with a sharp needle in the direction given by the bent-down, outer end of the horsehair. If necessary, the outer end of the horsehair is shortened and then inserted into the counterpuncture.

Viscous liquid cellophane is placed on the spot where the horsehair enters the counterpuncture to anchor it to the skin. After three weeks, epithelization is complete and the horsehair is removed. The patient has no discomfort during this period. If the cellophane loosens, allowing the horsehair to work its way out, it is replaced and reanchored.

Two cases[1] of lower canaliculi closed by scar tissue in the medial half and one case in which the lower punctum and the entire length of the lower canaliculus were closed by scar tissue have previously been reported. These were channelized with the aid of indwelling horsehair.

To the foregoing cases are now added two new ones in which the lower punctum and the entire lower caniliculus were scarred, and a third new case in which only the medial two thirds of the canaliculus was closed by scar tissue. In two of these three cases, the upper half of the nasolacrimal duct was found to be filled with scar tissue.

Case 5. Mr. T. J. J., aged 38 years, a pilot on a Great Lakes steamer, was seen in January, 1948. He had taken more than a hundred grains of aspirin in 24 hours to relieve a severe grippe, and soon became "swollen all over like a blister." The eyes and lids were affected first. He was hospitalized for three weeks. Since that time both eyes have teared, handicapping his work.

The left upper punctum was closed; the left lower canaliculus admitted a probe for about one third of its length. When the scar in the medial two thirds of the left canaliculus was penetrated, closure of the neck of the tear sac by scar tissue was detected. This was cut through by electrocoagulation, as was the scar tissue which filled the entire length of the nasolacrimal duct. There was no bleeding.

A horsehair was inserted in the newly channelized left lower canaliculus. Ten days later the horsehair was removed. Saline was readily irrigated into the nose. Another horsehair was inserted which the patient removed in 10 days. He wrote that tearing from his left eye had ceased.

His right eyelid suffered much more tissue destruction, especially around the lower lid at the inner canthus where the right lower canaliculus was sloughed away. At some future date, tearing of the right eye might be lessened by electrocoagulation of the lacrimal gland.

Case 6. Mr. J. S., aged 39 years, was seen in December, 1947. A former schoolteacher, he was now employed in the post office. Ten years ago, bilateral iridectomy was performed for glaucoma. The right eye had only light perception; the left eye was correctible to 20/30. Both eyes had teared for more

than two years, and had been probed with "bleeding." The patient was extremely apprehensive. Neither eye transmitted fluorescein into the nose. The nose was deflected and some postnasal discharge was present.

After dilation of a very tight right lower punctum, irrigation into the nose was easily done. The left upper canaliculus was tightly contracted and dilated with difficulty. With much pressure, a slight amount of saline was irrigated into the nose.

The left lower punctum was closed by scar. A sharp needle was pushed through the completely scarred canaliculus to contact the bony lacrimal fossa. A horsehair was inserted, the outer end of which was buried in a counterpuncture and anchored with cellophane.

Twelve days later the horsehair was replaced by another which was retained for two weeks. The left upper canaliculus was again dilated, now permitting easy irrigation into the nose.

At his next visit, the patient stated that there was no tearing, and that he read easily. Fluorescein was transmitted from each eye into the nose. During this period, the tear sac of the right eye was irrigated.

Sims displacement therapy and a nasal decongestant controlled the postnasal discharge. After several months, his almost sightless right eye began to tear again. It was again controlled. He was advised to have his deviated septum corrected to prevent further relapses.

Case. 7. A canaliculus is infrequently blocked by a foreign body, rarely by a tumor. A tumor blocked the medial end of the right lower canaliculus of Miss J. M., aged 40 years, causing tearing for six years. She was referred in February, 1947, for destruction of this tumor by electrocoagulation. (This patient had had trachoma in childhood.)

Irrigation was readily done through the right upper canaliculus, but no fluorescein was transmitted into the nose. No irrigation through the lower canaliculus was possible. A No.-6 probe came in contact with a soft obstruction attached to the lower surface of the canaliculus at its medial end. Gradual pressure downward by a probe flattened the tumor, allowing the probe to be passed into the tear sac. Immediately following this, irrigation into the nose was readily done. This tumor was probably a hemangioma.

Under local anesthesia, an electrode completely covered with insulation (Glyptal, General Electric), except at the spot which contacted the tumor, was inserted into the canaliculus and pulled downward in firm contact with it. The current (600 ma.) was momentarily applied. Because the mucosa and the soft structures of the canaliculus are easily damaged by excessive coagulation, I proceeded slowly.

Twelve days later, the coagulation was repeated, a little more current (1,000 ma.) being used for a slightly longer time. Three weeks later, there remained a small flattened hump of the original tumor. This was coagulated for the third time (850 ma.). There was slight bleeding for the first time. Two weeks later, the fourth and last treatment was given (1,300 ma. were momentarily applied). Three weeks later, the growth was completely gone, and tearing had ceased.

5. Tear sac, nasolacrimal duct, and nose

a. Blockage of that portion of the nose into which the nasolacrimal duct drains.

Hypertrophy of the mucous membrane of the inferior turbinate may be sufficient to interfere with tear conduction. The hypertrophy can be destroyed more accurately by electrocoagulation than by sclerosing solutions. I have previously reported[1] the use of this modality for the destruction of hypertrophic polypoid mucous membrane, as well as mucous polyps which caused chronic tearing by pressure on the tear-conduction system. If blockage continues long enough, the lining membrane of the nasolacrimal duct may hypertrophy, and must similarly be destroyed before tearing is cured.

b. Congenital closure of the lower end of the nasolacrimal duct.

H. Gifford, Jr.,[3] advises probing in congenital tearing as a last resort but not until the patient has reached the age of 6 to 9 months. Probing too early or using too large instruments may lead to permanent strictures or later serious complications. In contrast, Cassady[4,5] advocates early probing. He states that delay allows infection to become intrenched.

With such divergence of opinion, it seems prudent to adopt the advice of Judge[6] who states that the removal of detritus at the lower end of the nasolacrimal duct cures 25 percent of congenital cases, and expression of the tear sac cures 25 percent more—thus avoiding probing in 50 percent of the cases. (See also Riser.[7])

It is my belief that retrograde probing is the method of choice in the remaining 50 percent because it is a direct approach to the blockage. It should replace the more difficult, and possibly dangerous, probing through the delicate tissues of the canaliculus, tear sac, and nasolacrimal duct. It is simple to perform, and without complications.

Case 8. This was the procedure followed with I. G., aged nine months, referred in January, 1949, for tearing of the right eye since birth.

A stiff metal cotton applicator was cut to a length of 15 cm., the tip rounded. Two cm. from the tip it was bent to 45 degrees in a curve to fit under the inferior turbinate. The tip was roughened to hold a wisp of cotton.

Cotton was dipped into a two-percent cocaine solution, the excess was wrung out, and the pledget was inserted into the right nostril for five minutes. With the cotton-tipped probe, two-percent cocaine was applied under the inferior turbinate. At this spot, the closed end of the nasolacrimal duct is usually situated six mm. from the anterior end of the attached border of the inferior turbinate. Following cocainization, a drop of five-percent silver nitrate was applied to prevent possible bleeding. The cotton was removed from the tip of the bent probe and the probe inserted under the inferior turbinate.

The softness of the closed end of the nasolacrimal duct contrasts sharply with the bony resistance surrounding it, revealing its exact location. The end of the probe easily penetrated the soft obstruction and entered the lower end of the nasolacrimal duct. There was no bleeding.

When the patient was seen three weeks later, tearing had ceased, and fluorescein dropped in the right eye was rapidly transmitted into the nose.

The retrograde approach can be used when the nasolacrimal duct cannot be probed from above because of anatomic abnormalities. This is the only method which can be used to establish lacrimal drainage in the three percent of congenital cases not cured by repeated probings. To accomplish this, the bent probe is insulated except at its ends. When the point of the probe feels no bony resistance, the current is momentarily turned on, destroying the obstruction at the lower end of the nasolacrimal duct. Since there is no bleeding, there is no need for saline irrigation after perforation. If unsuccessful the first time, another attempt is made a few weeks later.

c. *Closure of the remainder of the nasolacrimal duct by scar tissue.*

The common finding is atrophic inferior turbinates with compensatory enlargement of middle turbinates. Younger patients usually have suffered injury to the nose, with deviation of the septum and hypertrophy of the middle turbinate opposite the deviation. Very few are of allergic etiology.

Atrophy of the inferior turbinates involves the nasolacrimal duct, dilating it widely especially anterposteriorly. The dilation extends upward, narrowing as it ascends to the neck of the tear sac. This narrowing is caused by bony hypertrophy involving the middle turbinate bone which is part of the ethmoid sinus.

Tyrrell[9] states that "some 75 to 80 percent of all cases of blocked nasolacrimal duct occur in women generally at or about the time of menopause. It is much less common among Negroes with their broad bridges to the nose. A striking similarity in sex and age incidence is found in atrophic rhinitis affecting the nasal mucosa while an affection of the bone causing otosclerosis offers a less close parallel." My experience has been similar to Tyrrell's.

Four cases of closure by scar tissue at the neck of the tear sac and in the nasolacrimal duct illustrate the type of tear sac selected for rechannelization. It will be noted that no discharge was present in the tear sac, or only a small amount which could be quickly eliminated by medicated irrigations.

Technique. A preliminary barbiturate and adequate local anesthesia are given. Two cc. of 1.5-percent monocaine is injected at about the junction of the lower and middle thirds of a line taken between the intraorbital foramen and the inner canthus; 0.3 cc. of the same solution is injected subcutaneously high up in the inner angle of the orbit.

To anesthetize the neck of the tear sac and the nasolacrimal duct, the minute nasal branch of the anterosuperior alveolar nerve which supplies these structures, must be blocked.[10] This is accomplished by injecting the infraorbital nerve 1.0 cm. proximal to its exit at its foramen. If the foramen is not located, or is not present as is occasionally the case, the block can be made in the inferior orbital fissure.

Case 9. Mrs. G. F., aged 49 years, was seen in October, 1947, for tearing of the left eye, which she had had for 10 years. Her nose showed evidence of previous injury. The left inferior turbinate was atrophic, and the exit of the nasolacrimal duct was widely dilated. The left nasal mucous membrane

was red and swollen, while that on the right side was normal. A left catarrhal ethmoiditis formerly caused several attacks of laryngitis. There was no discharge from the left tear sac. Probing had been done several times. Saline could not be irrigated into the nose.

The right eye transmitted fluorescein into the nose more slowly than normally. Scar tissue, obstructing the neck of the left tear sac, was cut through by electrocoagulation, as was scar tissue found at two points below it in the nasolacrimal duct. The insulated electrode, bent at a right angle to fit the concavity of the eye socket, was passed through the lower canaliculus, dilated to the calibre of a No.-6 probe. The amount of current used was 1,300 ma.

In three weeks, when the postoperative swelling subsided, tearing of the left eye ceased. Fluorescein was transmitted from the left eye into the nose more rapidly than from the other eye.

Case 10. Mrs. M. K., aged 49 years, was seen in April, 1947, with tearing of the right eye of eight months' duration. There was some pus in the right tear sac. She had been treated for three months by repeated probing and by slitting the right lower punctum and canaliculus. The right middle and inferior turbinates were markedly enlarged and swollen.

Electrocoagulation cut through firm fibrous tissue blocking the neck of the tear sac and the upper half of the nasolacrimal duct. Degenerated mucous membrane of the right inferior turbinate was similarly destroyed. Three weeks later, narrowing just below the neck of the tear sac was palpated with a No.-3 probe. This was coagulated a second time. Despite this, fibrous tissue reformed at this spot and was again similarly treated.

Two weeks thereafter, fluorescein was transmitted from the right eye into the nose more slowly than from the left eye. The inner end of the slit lower canaliculus was treated several times with five-percent silver nitrate and probing, thus closing the medial half of the slit. The right eye then transmitted fluorescein into the nose slightly slower than the left eye.

Case 11. Mrs. P. N., aged 41 years, was referred in March, 1948, for tearing of the right eye for one year. Her nose had been injured at the age of four. Both inferior turbinates were markedly atrophic, with compensatory enlargement of the middle turbinates, especially the right. Probing had formerly been done.

Electrocoagulation cut through scar tissue blocking the neck of the tear sac and the upper half of the nasolacrimal duct. She stated that there was moderate swelling and slight yellowish discoloration of the skin at the inner canthus for four days. Three weeks later, fluorescein was normally transmitted into the nose, and tearing ceased.

The right nasal mucous membrane was always abnormally reddened and wet, while the left nasal mucous membrane appeared normal. A dark discoloration of the skin under the right eye was more pronounced than under the left eye. To cure the underlying nasal sinusitis, the enlarged right middle turbinate was reduced by electrocoagulation and compression. The left middle turbinate was similarly treated at the same time. This procedure inconvenienced the patient very little.

Case 12. Mrs. E. D., aged 66 years, was referred in June, 1948, for uncontrollable tearing of both eyes, especially the left, for five years. No discharge was present in either tear sac. Marked atrophy of both inferior turbinates was present, with wide dilation of the lower ends of both nasolacrimal ducts. The left eustachian tube was more narrowed than the right. A contraction of the medial end of the left lower canaliculus was dilated.

Electrocoagulation cut through fibrous tissue at the neck of the left tear sac and in the upper half of the nasolacrimal duct. Sinus displacement therapy for the right eye was given three times. A nasal decongestant and eyedrops were prescribed for home treatment. The right eye responded quickly, transmitting fluorescein into the nose. The left eye transmitted fluorescein more slowly. A second electrocoagulation was given which increased the rate of dye transmission of the left eye.

Comment. In 15 cases, electrocoagulation was used to destroy fibrous tissue obstructing the neck of the tear sac and the upper portion of the nasolacrimal duct. One treatment sufficed permanently to remove the obstruction in five cases (one third). Two or three treatments were necessary to effect a cure in five (one third) more. When success was not attained after three treatments, this modality was abandoned (three cases, 20 percent).

In two cases (13⅓ percent) a false passage was made on the first attempt. In one, the end of the electrode projected under the inferior turbinate about 2.5 cm. posterior to the normal opening. In the other, the electrode projected above the inferior turbinate. In the five cases where electrocoagulation failed, cure was effected by making a new opening in the tear sac by the intranasal technique formerly described.[15]

When the more extensive procedure of forming a new intranasal opening is contraindicated, and when such a procedure is difficult because of severe deviation of the nasal septum, retrograde electrocoagulation may be tried.

In these cases, the neck of the tear sac is excessively narrowed by bony hypertrophy.

To combat such bony stricture, stronger current of longer duration is needed than can be used with safety to traverse the canaliculus. The retrograde approach, which leads the operator from a wide opening directly to the closure at the narrow upper end of the nasolacrimal duct, permits safe use of stronger current. It is difficult to find this small closed opening when approaching it from above.

The bent probe used in congenital cases cannot reach the neck of the tear sac when acquired closure exists. I have devised a flexible electrode that is pushed through a hard rubber eustachian catheter up to the neck of the tear sac. The end of the catheter is inserted into the lower end of the nasolacrimal duct, which usually is dilated. When the obstruction at the neck of the tear sac has been perforated, the end of the electrode is pushed further up into the tear sac where it can be palpated. When bony hypertrophy is so great that it resists two such attempts, a new intranasal opening should be made.

Factors determining the necessity for more than one electrocoagulative treatment, as well as the failure of this method to reestablish patency of the nasolacrimal duct, are: (1) The narrow caliber of the bony nasolacrimal duct; (2) the amount of scar tissue in the tear sac and nasolacrimal duct (if the mucous membrane lining of the tear sac has been replaced by scar tissue, the chance for cure by any method is slight); (3) the anatomic configuration of the nasolacrimal duct; (4) the amount of effective current, and its duration, that is applied to the obstructive scar tissue (this may vary with the amount of moisture in the scarred nasolacrimal duct, as well as the moisture on the patient's skin in contact with the indifferent electrode); (5) the use of too much pressure exerted by the electrode downward so that it tears through the obstruction before coagulating it; (6) individual differences in the tendency to scar-tissue formation.

d. Blockage primarily by swelling of the tear sac and nasolacrimal duct, often with spasm of the puncta and canaliculi.

Congenital narrowness of the bony nasolacrimal duct, excessive folds in its mucous membrane lining, diverticula, or other anatomic abnormalities favoring blockage predispose to lacrimal infection and chronic tearing.

Concerning the variability of the nasolacrimal duct, Schaeffer[11] writes: "Probing of the nasolacrimal duct would seem ill advised from an anatomic viewpoint owing to the very common irregularities and diverticula of the nasolacrimal duct and the occasional side to side union of the sac and the duct. . . . Unfortunately there is no way of knowing what type of duct confronts the operator. . . . The success or failure of nonsurgical treatment of the diseased nasolacrimal passages is largely dependent upon the anatomic type of the nasolacrimal duct and ostium encountered."

Whitnall[12] reported that, in 54 percent of 100 European skulls, the anterior ethmoidal cells extended as far as the anterior margin of the lacrimal groove. In addition, there is a close anastomosis between the venous and lymphatic plexuses of the ethmoid and maxillary sinuses and the lining membrane of the lacrimal drainage apparatus. This relationship makes the lacrimal drainage apparatus susceptible to inflammatory lesions of the nasal sinuses.

Chronic nasal sinus disease, especially ethmoiditis, first affects the tear sac and the nasolacrimal duct with swelling. It is well known that danger to the eye may arise from purulent sinus infection. Obscure, chronic, nonpurulent inflammation of the ethmoid cells may similarly extend through the lacrimal bone, producing local periostitis[10] of the lacrimal groove, with swelling at the inner canthus. This swelling involves the lacrimal apparatus and the eyelids, causing pressure on the canaliculi which narrows their lumen.

In addition, sinusitis may produce spasm of all or part of the orbicularis oculi muscle. Fibers of this muscle, arranged in a circle around each punctum, form a sphincter. Less

often,[12] spirally arranged muscle fibers surround the canaliculi. Chronic spasm of these muscle fibers leads to hypertrophy, thus contracting the lumen of the punctum and canaliculus.

Variations in these findings are explained by the absence of the sphincter muscle of the punctum, as reported by Cattaneo,[17] and the absence of spirally arranged muscle fibers surrounding the canaliculus reported by several other workers.[12]

Case 13. Mrs. C. K., aged 30 years, was referred in April, 1947, for tearing of the right eye for one year. Although no fluorescein was transmitted from the right eye into the nose, irrigation washed out much dye-stained mucus.

The nose showed evidence of previous injury, the septum being deviated to the left, with a marked enlargement of the right middle turbinate whose membrane had undergone chronic degenerative changes. Marked atrophy of both inferior turbinates was present, as was a considerable amount of mucopus in the right side of the nose, produced by a chronic right ethmoid and antrum infection.

The exit of the right nasolacrimal duct was dilated. The nasal sinus infection was treated by sinus displacement irrigation, and home treatment with a nasal decongestant was prescribed.

At the patient's third weekly visit, tearing had ceased and the nasal discharge was much reduced. Fluorescein was transmitted into the nose, but not as rapidly as from the left eye. No.-3 and No.-4 probes came in contact with fibrous obstruction at the neck of the tear sac. Two more weekly treatments were given to improve her nasal condition as much as possible.

Two small polypoid masses of degenerated mucous membrane attached to the right middle turbinate were then destroyed by electrocoagulation. The right middle turbinate was reduced about one third of its original size by electrocoagulation and compression. This office procedure inconvenienced the patient very little. If this nasal correction had not been made, the fibrous-tissue obstruction already forming at the neck of the tear sac would have progressed, causing tearing.

Case 14. This case is an example of more marked irreversible changes within the nasolacrimal duct short of complete closure, occurring after more than 15 years of blockage.

Mr. H. B., aged 55 years, was referred in January, 1948, for tearing of the left eye for over 15 years. The right eye teared occasionally for a shorter time. Fluorescein was transmitted from the right eye into the nose, but not from the left eye. Only when a long lacrimal needle was passed through the neck of the left tear sac could some saline be irrigated into the nose. Allergic history was negative. The puncta and canaliculi were normal.

An unusually large, thick-walled polyp, attached to the middle turbinate, rested on the floor of the nose, yet the patient never complained of nasal obstruction. When this mass was removed, two more small mucous polyps were destroyed by electrocoagulation, as was the area from which the large polyp originated.

Following this, I expected swelling of the nasolacrimal duct to subside, and tearing to cease. After two months of waiting, this was not the case. Apparently, irreversible changes had occurred in the nasolacrimal duct.

Electrocoagulation cut through a fibrous obstruction encountered at the neck of the sac and in the upper two thirds of the nasolacrimal duct. Two weeks later, dye was not transmitted, but irrigation was readily done. The following week, fluorescein was transmitted into the nose for the first time. Tearing ceased. When the patient was last seen, one month later, there was no tearing of the left eye.

The occasional tearing of the right eye was cured by nasal-sinus irrigation and the use of a nasal decongestant. If the nasal polypi had been removed much earlier, electrocoagulation of the nasolacrimal duct, almost completely closed by scar tissue, would not have been necessary.

Case 15. Closure of the medial portion of the canaliculi by long-enduring spasm of muscle fibers spirally arranged around them is illustrated by the case of Mrs. M. O., aged 57 years, who was seen in October, 1946. Her right eye had teared for 20 years, her left eye for three years.

Slight thickening of the sac wall was palpated only on the right side, but no discharge was present in the tear sac. Neither eye transmitted fluorescein into the nose. Atrophy of both inferior turbinates was present, with the nasal septum deviated moderately to the right. The left middle turbinate was moderately enlarged. Much mucopus was present in the nose. There was a hearing loss of about 70 percent in both ears.

The right upper and lower canaliculi were closed in the medial three fourths of their length. On irrigation of the left eye, after the nose had first been cleansed of its discharge, a surprisingly large amount of mucopus was washed out into the nose.

In four fortnightly treatments, the tightly contracted right lower canaliculus was gradually opened, without bleeding. Sinus displacement treatment was given. The usual home treatment for the nose and eye was prescribed.

At the second treatment, the left eye had ceased tearing and transmitted fluorescein into the nose. At the fourth treatment, the entire length of the right lower canaliculus passed a No.-3 probe. Then, for the first time, irrigation washed a surprisingly large amount of mucopus from the right nasolacrimal duct. Tearing ceased, and has remained so.

Case 16. This case is unusual in that tearing of long duration resisted treatment until the underlying nonproductive catarrhal sinusitis was adequately cared for.

Mr. H., aged 69 years, was seen in the summer

of 1946. Both eyes had teared for over 20 years, the right more than the left. Repeated irrigation of the tear sac had proved of little value. There was no discharge in either tear sac, nor was any seen in the nose or throat. The nose showed evidence of injury, with the nasal septum deviated above to the right.

No fluorescein was transmitted into the nose from either eye. A surprisingly large amount of dye-stained mucopus was irrigated from both nasolacrimal ducts into the nose. Sinus displacement irrigations with saline were given once a week for several weeks, and a nasal decongestant prescribed for home use. Both eyes soon stopped tearing and fluorescein was transmitted into the nose in a normal manner.

Two years later (during which time he suffered a heart attack), he complained of occasional tearing of the right eye. Some dye-stained mucus was irrigated from the right nasolacrimal duct into the nose, and tearing ceased.

Comment. In the last two cases, the surprisingly large amount of discharge irrigated was probably due to the fact that mucopus had accumulated either in a widely dilated tear sac narrowed at its bottom, or in a large diverticulum of the nasolacrimal duct. X-ray studies with a contrast medium might have revealed such a condition. The long-standing tearing in Case 16 was the result of a nonpurulent catarrhal sinusitis; tearing in Case 15 resulted from a productive purulent nasal sinusitis. In both cases, repeated irrigation of the lacrimal apparatus alone failed to relieve tearing. However, when this was combined with sinus irrigation by displacement, tearing soon ceased.

Sinus irrigation by displacement washes out discharge, thus revealing obscure nasal sinusitis. Vasoconstrictors, sulfa, or antibiotic solutions may be added to the saline irrigating solutions. Instillation of a contrast medium into the sinuses before X-ray study aids in revealing obscure nasal sinusitis. Ocular disease and abnormalities may be caused by hidden sinus infection and often do not respond to conventional treatment until the underlying nasal sinus infection is eradicated.

Other uses for electrocoagulation

The pressure of pus in a severe infection may markedly dilate a tear sac. To drain and cure such chronic infection, the dilated tear sac must be dissected before the bony intranasal opening is made. It may then be pushed through the bony opening, after cutting a window in it for drainage (or flaps cut out of it may be sutured to nasal mucous membrane flaps).

Simpler than dissection of the dilated tear sac is the use of electrocoagulation to destroy its dependent portion. Electrocoagulation may be applied through a vertical incision made with cutting current through the skin into the tear sac; or, when a fistula exists, it may be applied through a vertical incision in the fistula.

Case 17. Mrs. D. R., aged 50 years, was referred in June, 1945. The left eye had teared for several years. The left side of her face had become swollen several times following instrumentation. The last attack was relieved by fistula formation. Three weekly treatments reduced the infection. Then, an electrode, its end bent at a right angle, was inserted through the fistula in radiating directions, destroying the dependent portion of the dilated sac. The medial wall of the tear sac was thoroughly coagulated.

Through this coagulated area, a large bony opening was made into the nose. The fistula drained some discharge, and soon closed. At the sixth week, threatened closure by scar tissue at the lateral surface of the bony opening was combatted with electrocoagulation. Two years later, Mrs. D. R. stated that her eye no longer troubled her.

Case 18. Another case of an unusually large, dilated tear sac without fistula formation was that of Mrs. S. R., aged 42 years, who was referred in December, 1947. She wore a small bandage to cover its unsightly appearance. Her right eye had teared for 11 months. Severe inflammation of the tear sac had required incision. A nasal plastic operation had been performed, against the advice of one surgeon, 15 years before. Both inferior turbinates were markedly atrophic. Profuse, sticky mucopus was present in the nose, more on the right side.

The tear sac was full of purulent matter. Pressure necrosis of the nasal bone caused by dilatation of the tear sac was present. Sulfa was instilled into the tear sac. Penicillin was used once but she was sensitive to it. Catarrh of the right ear occurred several times, as did a severe attack of bronchitis, delaying operation for six months.

A vertical incision was made with cutting current through the skin into the tear sac, the dependent part of which was destroyed by coagulation. The medial wall of the tear sac was then thoroughly coagulated. An intranasal bony opening through this coagulated area was then made. Pus drained onto the face. The incision closed in four weeks.

At the end of six weeks, threatened closure by scar tissue at the lateral surface of the bony opening was combatted by electrocoagulation. Tearing then ceased, and fluorescein was normally transmitted from the eye into the nose. The healed incision was scarcely visible.

Comment. Threatened closure of a new intranasal opening by fibrous tissue must be combatted by electrocoagulation. Whitnall[12] calls this fibrous tissue the lacrimal fascia. It is attached with the periosteum to the anterior and posterior lacrimal crests, and splits to enclose the tear sac.

The posterior lacrimal crest is easily removed, since it is part of the thin lacrimal bone. The anterior lacrimal crest, however, is composed of the very hard nasal process of the superior maxilla. The greatest difficulty in intranasal methods is encountered in attempting to remove this hard bone in order fully to open the medial sac wall.[13] West[14] stressed the importance of the extirpation of the tear sac in his intranasal technique. To accomplish this, extensive intranasal resection is necessary. In order to overcome this difficulty, I have slightly altered the method formerly used to open the tear sac by electrocoagulation[15] to include destruction of the anterior part of the medial sac wall and its investing lacrimal fascia.

A straight insulated electrode, passed through the previously dilated lower canaliculus, is used to destroy the entire medial sac wall, especially the anterior portion bordering the anterior crest.

In this manner, the regrowth of lacrimal fascia and periosteum is retarded so as to allow the ethmoidal and nasal mucous membrane to grow across the bony opening, thus maintaining its patency. The same electrode is used to combat closure after any operative method employed. The bony opening narrows but it does not close completely, even after a long period of time.

This modality is especially useful in lacrimal surgery because it eliminates bleeding. It may be used (a) to open a tear sac in order to destroy blockage at its neck and in the nasolacrimal duct with stronger current than can safely traverse the canaliculus; (b) to prepare flaps in the medial sac wall and in the adjacent nasal mucous membrane for suturing together after the intranasal bony opening has been made; (c) to obliterate[8] the tear sac in infantile dacryocystitis when the limited field and hemorrhage make surgical procedure difficult or impossible.

Summary

1. Muscular weakness of the lower eyelid may be corrected by electrocoagulating acupunctures.

2. Marked degrees of eyelid muscle weakness require repetition of this procedure as well as electrocoagulation of the lacrimal gland to lessen tear production.

3. In complete facial paralysis, pressure on the eye may be relieved by electrocoagulating acupunctures of the upper lid.

4. Electrocoagulation of the lacrimal gland may lessen tear production when reconstruction of the tear-conducting apparatus is impossible or very difficult.

5. An everted lower punctum may be turned backward to contact the lake of tears by electrocoagulating acupunctures at its base.

6. Puncta and canaliculi closed or destroyed by scar tissue can be rechannelized.

7. Electrocoagulative destruction of a tumor within the lower canaliculus is described.

8. Advantages of the retrograde approach for cure of congenital cases are listed. The retrograde approach combined with electrocoagulation is the only method for cure of congenital cases that have resisted repeated probings.

9. Electrocoagulation may be used for obliteration of the tear sac in infantile dacryocystitis when surgical procedures are difficult or impossible.

10. Hypertrophic mucous membrane and other growths that block the portion of the nose into which the nasolacrimal duct drains are readily destroyed by electrocoagulation.

11. About three fourths of all cases of

blocked nasolacrimal ducts occur in women about the time of menopause.

12. Electrocoagulation destroys scar tissue blocking the neck of the tear sac and the upper half of the nasolacrimal duct.

13. When a hypertrophic middle turbinate has caused blockage of the nasolacrimal duct, it should be reduced following rechannelization of the blocked nasolacrimal duct to prevent possible recurrence and to cure the underlying chronic nasal sinusitis.

14. Four interesting cases of chronic tearing due to blockage by swelling are described.

15. Spasm of the muscle fibers encircling the punctum and/or the canaliculus may result in chronic tearing.

16. The dependent portion of a markedly dilated tear sac may readily be destroyed by electrocoagulation prior to its intranasal drainage.

17. Electrocoagulation may be used to open the tear sac to prepare flaps for suturing it to adjacent nasal mucous membrane; to combat possible postoperative closure, electrocoagulation is invaluable.

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SOME OCULAR EFFECTS OF A NEW ANTICHOLINESTERASE AGENT*

TETRAETHYL PYROPHOSPHATE (TEPP) AND ITS USE IN THE TREATMENT OF CHRONIC GLAUCOMA

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Several esters of phosphoric acid are potent inhibitors of the cholinesterase (ChE) enzymes. One of these esters, di-isopropyl fluorophosphate (DFP), has a pronounced cholinergic effect when instilled into the normal eye, producing prolonged miosis, ciliary spasm, and reduction in the intraocular pressure.[1] DFP has been employed in the treatment of glaucoma, but its value has been limited by the occurrence of ciliary spasm with associated brow-ache, headache, eye-ache, and visual blurring; by the occasional occurrence of increased intraocular pressure; and by the development of retinal detachments in myopes with glaucoma.[2] DFP inhibits ChE enzymes irreversibly and has pronounced cumulative action when administered repeatedly, producing progressive diminution toward zero of the ChE activity of the tissues it reaches.[3]

A study has been made of the ocular effects of another ester of phosphoric acid, tetraethyl pyrophosphate (TEPP), which, while a more potent inhibitor of ChE enzyme than DFP, does not inhibit ChE entirely irreversibly, and is less cumulative in its action when administered repeatedly.[4]

TEPP is a colorless mobile liquid which is miscible with water and many of the organic solvents, except the paraffinic oils. It is hygroscopic and absorbs moisture readily from the air. TEPP is stable under normal storage conditions when protected from air and moisture. In the presence of water, hydrolysis occurs with the production of acidic compounds of a lower order of potency. Mangun[5] has shown that an aqueous solution of TEPP at room temperature loses half its biologic activity in seven hours, while in 24 hours the solution is less than one tenth as potent as it was when originally prepared. Because of the instability of TEPP in aqueous solution peanut oil was used as a vehicle. TEPP has been shown to be stable in peanut oil for months.[4]

ANIMAL EXPERIMENTS

Rabbits were employed to study the local ocular effects of TEPP and to determine whether TEPP had any effects on the morphology of ocular tissues after repeated local administration. Young adult mongrel rabbits were used for the experiments. TEPP, with peanut oil as a vehicle, was used in concentrations ranging from 0.025 to 4.0 percent. The instillation was made into the conjunctival cul-de-sac of the right eye, with the left eye serving as a control.

One drop, from a standard eye dropper, of 0.025-percent TEPP produced incomplete pupillary constriction beginning within 15 minutes and lasting for 18 hours. There was no ciliary injection with this concentration. The weakest concentration which produced maximal miosis was one drop of 0.2 percent TEPP. The pupil returned to normal after 24 hours. A mild ciliary injection which lasted for approximately six hours also developed.

One drop of two-percent TEPP produced maximal miosis in 15 minutes and moderate conjunctival and ciliary injection which lasted for 8 to 12 hours. The pupil returned to normal after 24 to 36 hours. In some instances after 24 hours, the pupil of the eye which had received the TEPP was slightly larger than its control.

* From the Departments of Ophthalmology and Medicine of the Johns Hopkins University and Hospital. This work was performed in part under contract between the Chemical Corps, U. S. Army, and the Johns Hopkins University. The TEPP was provided by the Chemical Corps and by Dr. John S. Harris, Monsanto Chemical Company, Saint Louis, Missouri.

When one drop of a four-percent solution of TEPP in peanut oil was instilled into each eye of a rabbit there occurred not only marked bulbar injection, miosis, and lacrimation, but also systemic effects, including weakness, diminished intake of food, and excessive salivation, lasting for a period of 12 hours.

The ocular effects of TEPP in general resembled those of DFP, the chief difference being in the somewhat shorter duration of the effects of TEPP. One drop of a 0.1-percent solution of either drug produced within 15 minutes miosis which was not quite maximal. The miosis lasted for 24 hours after TEPP and for 36 hours after DFP.

Seven rabbits were used in the experiment which was undertaken to determine whether TEPP had any effect on ocular tissues after repeated local administration. One drop of a two-percent solution of TEPP in peanut oil was placed daily in the right eye of each rabbit, while the left untreated eye served as a control.

One of the rabbits died after receiving the TEPP for five weeks. Although the cause of death was not determined, it was noticed that, after receiving the TEPP for approximately five weeks, the rabbits were not as active nor did they gain weight as rapidly as normal controls. The ChE activity of the whole brain (homogenized) of the rabbit treated for nine weeks was reduced to less than 30 percent of normal activity.

The six remaining rabbits which received two-percent TEPP in the right eye daily were killed after varying intervals ranging from 2½ weeks to 9½ weeks. In all cases both eyes were removed after the animal was killed, and the eyes fixed, sectioned, and stained with hematoxylin and eosin or Verhoeff-van Gieson stain. Sections made from all of the eyes were examined by Dr. Jonas Friedenwald and found to show no morphologic abnormality.

Observations on normal human eyes

To determine the effectiveness of tetraethyl pyrophosphate as a miotic in the normal human eye, concentrations of TEPP in peanut oil ranging from 0.0125 percent to 0.2 percent were employed. In all tests one drop of the TEPP solution was placed in the right eye and one drop of peanut oil was placed in the left eye which served as a control.

A 0.0125-percent solution of TEPP in peanut oil produced a definite pupillary constriction within 30 minutes, and no other changes. This concentration agrees closely with the minimal effective concentration for the production of perceptible miosis as reported by Grant.[6]

A 0.05-percent solution produced maximal miosis in from 20 to 40 minutes and some pupillary constriction remained for two days. In addition to the miosis, ciliary spasm developed and lasted for 12 to 18 hours. With this concentration mild conjunctival injection lasting for a few hours developed in some subjects. No significant change was found in the ocular tension with a 0.05-percent solution.

At the time of instillation no pain or discomfort was experienced but, in a few of the subjects, supraorbital pain developed after approximately 15 minutes. With the stronger solutions, such as 0.1 and 0.2 percent, maximal miosis developed in 15 to 20 minutes and some miosis was present for two weeks. About five minutes after placing the drop of 0.1-percent TEPP in the cul-de-sac, twitching of the lids was sometimes noticed and many of the subjects developed, after 15 to 20 minutes, superorbital pain which lasted for 1 to 2 hours. Mild ciliary injection as well as conjunctival injection also frequently occurred.

Leopold and Comroe[1] reported that DFP in appropriate concentrations could overcome the mydriatic and cycloplegic effect of homatropine and atropine. TEPP also can influence the effects of homatropine and atropine. A pupil widely dilated by one drop of five-percent homatropine can be constricted to 1 or 2 mm. within 30 minutes by one drop of 0.05-percent TEPP. One drop of a 0.2-percent solution of TEPP can maxi-

mally constrict a pupil dilated by one drop of one-percent atropine.

In addition the pinhole effect of a constricted pupil can improve visual acuity which was reduced by the mydriasis and cycloplegia of the atropine. For example, a 14-year-old white boy with 2.0 diopters of hyperopia had only 20/100 uncorrected vision and a widely dilated pupil five hours after the instillation of one drop of one-percent atropine. One hour after receiving one drop of 0.2-percent TEPP his pupil was 1.5 mm. in diameter and his visual acuity was 20/20 with or without the correction of his 2.0 diopters of hyperopia. It is of interest that the prior administration of atropine or homatropine in this and other patients prevented the development of conjunctival and ciliary injection after the administration of concentrations of TEPP which in normal eyes produced congestion.

The use of TEPP in chronic glaucoma

TEPP was used in 31 eyes with chronic glaucoma. The 31 eyes represented 21 patients, of whom 9 were white and 12 colored. All of the eyes had primary wide-angle glaucoma except for two eyes with primary chronic narrow-angle glaucoma, one with glaucoma capsulare, one with glaucoma secondary to a cataract extraction, and one with glaucoma secondary to an inactive uveitis. In all of these patients the glaucoma, which was definitely chronic, was uncontrolled by the use of such miotics as pilocarpine (two percent), eserine (0.25 percent), and furmethide (10 percent).

TEPP was used, therefore, on patients of whom more than half were colored and all of whom were uncontrolled by the more conventional miotics.

Most of the patients received TEPP for a period of about three months while the longest period was five months. TEPP was used in 0.05-, 0.1-, and 0.2-percent concentrations in peanut oil and the frequency of instillation of one drop varied from 1 to 3 times a day. The administration of TEPP in these amounts did not result in the systemic absorption of significant amounts of TEPP. There were no systemic symptoms in any of the patients that could be attributed to the TEPP.

In addition, red blood cell and plasma ChE determinations performed on several patients prior to the administration of TEPP and at intervals while they were receiving the drug locally showed that TEPP in the amount and concentration used by patients being treated for glaucoma had no influence on the red blood cell or plasma ChE activity.

In the 31 eyes of this series five eyes had the ocular tension, as measured by a Schiøtz tonometer, maintained at or below 30 mm. Hg and were considered to have been successfully treated by TEPP. In two of the five successfully treated eyes, the tension was controlled by one drop of 0.05-percent TEPP once a day for three months. In two other eyes the tension was not controlled with 0.05-percent TEPP twice a day but was controlled with 0.1-percent TEPP three times a day for six weeks. The remaining successfully treated eye was controlled for three months with 0.1-percent TEPP twice a day. This same eye was also controlled by 0.1-percent DFP twice daily.

Of the 26 eyes which could not be successfully controlled by TEPP, 20 eyes were classified as unsuccessfully treated because the tension was not maintained within normal limits by TEPP. In the six remaining eyes (representing four patients) treatment with TEPP was considered unsuccessful because of the local symptoms which occurred.

One patient had severe bilateral brow-ache following each dose of one drop of 0.2-percent TEPP in both eyes and refused to continue the use of TEPP. Another patient had blurred vision and supraorbital pain following the use of 0.05-percent TEPP twice a day in both eyes for three doses and stopped this treatment. In the third patient, TEPP was discontinued because the morning dose of 0.1-percent TEPP blurred his vision so much that he had difficulty with his work, and his tension could not be controlled by a 0.1-percent solution administered at night

only. The fourth patient developed a local reaction to TEPP, with redness and itching of her eyes which necessitated discontinuing the drug.

Several of the patients in whom the glaucoma was not controlled by TEPP and who, therefore, were classified as failures because the tension was not maintained within normal limits also had symptoms following the use of TEPP which made the drug unsatisfactory as a miotic for the treatment of chronic glaucoma. Patients with good vision were especially annoyed by the artifical myopia from the ciliary spasm induced by TEPP.

For example, one patient who had 20/30+ corrected vision in both eyes while on the conventional miotics had only 20/100 vision in both eyes with her glasses when she was using 0.05-percent TEPP twice a day. While on TEPP she was refracted and, when her hyperopic correction was reduced by 1.50 diopters in each eye, her vision was again 20/30+. She was given new glasses but stated that even with her new correction her vision was so blurred in the morning from the drop instilled the previous night that she was unable to read the morning paper before noon.

Another patient with 20/20 corrected vision was given 0.2-percent TEPP to use twice a day. Her vision was reduced to the 20/50 level following the administration of TEPP and, since this was unsatisfactory, she was tried on 0.05-percent TEPP at night only. The vision, when tested in the afternoon clinic, had returned to 20/20 but the tension was not controlled. She was then advised to use 0.05-percent TEPP twice a day and when she returned her vision was unsatisfactory and her tension not controlled.

Five patients out of the 21 treated with TEPP in peanut oil developed a local reaction suggestive of sensitivity to TEPP. In each case the reaction was determined to be due to the TEPP rather than to the peanut oil by the instillation separately and at different times of peanut oil and of fresh aqueous solutions of TEPP. In three patients, the local effects included conjunctival injection without lid involvement while in one patient, the lids became red, edematous, and desquamation developed while there was only minimal conjunctival injection. The fifth patient showed involvement of both the lids and conjunctiva. These untoward local effects of TEPP did not develop until the drug had been administered daily for five or more weeks. They could be reproduced in the same patients by the subsequent administration of single instillations of TEPP in aqueous solution or in peanut oil, suggesting that they are manifestations of local sensitivity to TEPP.

One of the 21 patients in this series developed a detachment of the retina while being treated with TEPP. This is reported in full.

Report of a case

A 32-year-old colored woman had been followed in our clinic since 1934. When first examined, she had a normal right eye and, in the left eye, her lens was partially cataractous and dislocated upward, apparently the result of trauma as a child. She was refracted at that time and had 20/20 vision in the right eye and 20/70+1 vision in the left eye with an aphakic correction. There was no evidence of glaucoma.

She did not visit the clinic between 1940 and 1948 but, when she returned, she had wide-angle glaucoma in both eyes in addition to the partially dislocated lens in the left eye. Since much of her vision in the right eye had been destroyed by glaucoma, she was given an aphakic correction for the left eye and ultimately obtained 20/30+ vision in the left eye.

Because the glaucoma in the left eye could not be controlled by eserine (0.25 percent) or furmethide (10 percent) an effort was made to maintain the intraocular pressure within normal limits by instilling one drop of 0.1-percent TEPP in peanut oil in the left eye twice a day. Over a two-month period, TEPP was no more successful than the other miotics had been. Then suddenly, without pain, there was a drastic reduction

in vision in the left eye. The following day, when she was examined in the clinic, the tension of the left eye was found to be pathologically low and, after dilating the pupil, a detachment of the lower half of the retina was discovered.

In this case, the TEPP was used for a period of two months before the retinal detachment suddenly developed so that the role of the TEPP in the development of the detachment is not clear-cut. In a case previously reported[2] in which the symptoms of a retinal detchment developed in a man with moderate myopia and primary wide-angle glaucoma after a single instillation of DFP, the detached retina could be attributed to the DFP with reasonable certainty. However, there are other cases in the literature in which a retinal detachment developed after a miotic had been used for longer periods of time.

Leopold and McDonald,[7] for example, report a case of a man with moderate myopia and primary wide-angle glaucoma in whom a retinal detachment was first noticed 16 days after the beginning of daily DFP therapy. In the three cases reported by Gradle and Snydacker,[8] the retinal detachment developed following the use of pilocarpine and eserine for the treatment of glaucoma in a period of time varying between 1 and 6 weeks. Two of their cases were myopic and one had a slight, mixed astigmatism.

Our patient treated with TEPP was myopic in the eye which developed a detachment. She also had had a subluxation of the lens on a traumatic basis for many years.

Conclusions and Summary

1. The instillation of TEPP in the eyes of normal and glaucomatous human subjects produced prolonged miosis, ciliary spasm, and ciliary injection.

2. High concentrations of TEPP instilled into the eyes of rabbits produced evidence of systemic absorption of the drug and of systemic effects, but no evidence of morphologic changes in the ocular tissues. Lower concentrations of TEPP administered to human subjects did not produce evidence of systemic absorption.

3. Patients with chronic glaucoma whose tension had not been controlled by pilocarpine, eserine, or furmethide, in general, did not have their intraocular pressure controlled by TEPP in concentrations from 0.05 to 0.2 percent. TEPP in these concentrations produced a fairly high incidence of ciliary spasm with brow-ache and artificial myopia, and of local reactions suggestive of sensitivity.

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MODERN MANAGEMENT OF OCULAR INFECTIONS*

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In spite of the voluminous literature regarding chemotherapy of ocular infections, a comprehensive plan of therapy that can be used by physicians has not yet appeared. Because of the rapid progress made in this field, treatment considered modern as recently as one year ago is now outdated. I have attempted in this report to systematize the available information and to formulate a simple but comprehensive plan of therapy.

PRINCIPLES OF OCULAR CHEMOTHERAPY

The use of chemotherapeutic agents in ophthalmology is based upon the same general principles as when these agents are used elsewhere in the body. These principles are that (1) organisms causing the infection must be sensitive to the chemotherapeutic agent and that (2) an effective concentration of the chemotherapeutic agent must reach the site of the infection and come in contact with the organism.

Present-day ocular therapeutics require that the physician have a greater knowledge of bacteriology and pharmacology than was necessary with the older forms of therapy. It is important, now, not only to make a clinical diagnosis, but also a bacteriologic diagnosis. The physician must know the antibacterial spectrum of each chemotherapeutic agent and, what is even more important, he should know the methods for testing the sensitivity of the various organisms to these agents.

The information obtained from sensitivity tests is of the utmost importance, for an organism isolated from an ocular infection which is insensitive to a chemotherapeutic agent in vitro will certainly not respond to it in vivo. Further, the physician should be informed of the variations in sensitivity of bacteria, the possibility of development of resistance of organisms to the various preparations, and methods of therapy which minimize this danger.

In addition to this bacteriologic information, the physician should have at his command a knowledge of the proper methods of administration and the dosage schedules of the various agents to ensure an effective therapeutic concentration at the site of infection.

This report is limited to those agents which have proved their value in ophthalmology or show great promise. These include sulfonamides, penicillin, streptomycin, bacitracin, aureomycin, and chloramphenicol (chloromycetin).

SULFONAMIDES

Although the availability of penicillin and other antibiotics has dampened the enthusiasm for the use of the sulfonamides in ocular infections, they still occupy a prominent place and in many instances are definitely the agent of choice. The most noteworthy advance in sulfonamide therapy is undoubtedly the introduction of multiple sulfonamide preparations.

Lehr[1] has shown that the use of a sulfonamide mixture is very advantageous in that a high blood concentration is maintained with a decreased incidence of crystalluria, toxicity, and hypersensitization.

The ophthalmologist gains an additional advantage because of the higher sulfonamide concentrations that are achieved in the aqueous. Recent experiments have shown that the aqueous-blood ratio may reach 70 or 80 percent with the use of sulfonamide mixtures administered orally as compared to ratios of 40 to 50 percent with the administration of single sulfonamides.[2] It is possible

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that with the higher concentrations thus achieved, heretofore resistant ocular infections may now become amenable to treatment with sulfonamides.

Other advances in sulfonamide therapy which may be of value in ocular infections have been the development of such new compounds as sulfamylon, sulfamezathine, and gantrisan. Experiments are now in progress at Northwestern University to evaluate their effectiveness in ocular infections but data at present are incomplete.

Penicillin

The effectiveness of penicillin in certain external ocular infections is well established. It is also known that penicillin is frequently ineffective in intraocular inflammation even if caused by pathogens sensitive to this antibiotic. The failures in such instances have been attributed mainly to the very low concentrations of penicillin obtained in the ocular tissues and fluids by the usual methods of administration. In this regard, it should be realized that the level of penicillin achieved in the ocular chambers is only about one tenth of that in the blood.

Since it has been estimated that 0.1088 unit of penicillin per cc. is required to destroy a typical Gram-positive organism such as the pneumococcus at a maximum rate in vitro, the objective in therapy is to achieve ocular levels within this range or higher. The usual methods of administration of aqueous solutions of penicillin and also the repository administration of penicillin for the purpose of sustaining high blood levels by prolonged absorption produce aqueous and vitreous levels of penicillin that are theoretically inadequate for the treatment of intraocular infections.[3]

Stimulated by von Sallmann's[4] report that, after ligation of the renal vessels in rabbits, a high blood level of penicillin and a subsequently higher aqueous level of penicillin are obtained, my associates and I are undertaking investigations to determine if similar high ocular levels of penicillin can be obtained clinically by blocking the transport mechanism for penicillin in the kidney by the use of caronamide.[5] We anticipate that, by such a suppression of penicillin excretion, high blood levels of penicillin may be maintained for a sufficient period of time to permit an increase in the concentration of penicillin in the eye.

Streptomycin

The discovery of streptomycin gave the ophthalmologist another valuable tool in combating certain ocular infections caused by organisms insensitive to sulfonamides and penicillin.[6] As with penicillin, the poor penetrability of streptomycin has accounted for some of the poor results. The incidence of neurotoxic symptoms has restrained widespread use of streptomycin and dihydrostreptomycin. It has been shown that the effectiveness of streptomycin against tuberculous infections of the eye can be increased by the simultaneous administration of promin and promizole,[7] and paraminosalicylic acid.[8] Most recently Waksman and his co-workers have isolated a new antibiotic, neomycin, which shows promise of being as effective as streptomycin but less toxic.[9]

Bacitracin

Recent reports indicate that bacitracin has an important place in ocular therapeutics.[10] This antibiotic has a bacterial spectrum similar to penicillin. It is inferior to penicillin in that it is too toxic for systemic use. However, bacitracin has advantages over penicillin; namely, in that it has been found to be more effective against certain strains of staphylococci than has penicillin. Further, up to the present time, no enzyme, resembling penicillianase, which inhibits the action of bacitracin has been discovered. In addition, the development of hypersensitization following the external use of bacitracin rarely, if ever, occurs. Bacitracin, therefore, is an effective and safe agent for the treatment of external ocular infections which formerly required sulfonamide or penicillin therapy.

Aureomycin

Among the more recent antibiotics that have been available, aureomycin holds great promise in the treatment of certain ocular infections, heretofore resistant to chemotherapeutic agents.[11, 12] It has approximately the same applicability as streptomycin in ocular infection but in addition to this has the marked advantage of being relatively nontoxic and is readily absorbed from the gastro-intestinal tract. It is superior to streptomycin for brucellosis and lymphogranuloma venereum infections of the eye and, further, it is the only antibiotic that is effective against the viruses of herpes simplex and epidemic keratoconjunctivitis. In tuberculous infections it is decidedly inferior to streptomycin.

Chloramphenicol

At present, investigations are proceeding with chloramphenicol (chloromycetin) which has antibacterial properties similar to aureomycin. Chloramphenicol shows promise in treatment of virus and rickettsial infections. Its chief disadvantage compared with aureomycin is its insolubility in water, although it is readily soluble in propylene glycol.

Clinical Management of Ocular Infections

The recent developments in the field of chemotherapy of ocular infections have been briefly reviewed. A general guide for the clinical management of patients will now be presented. Although this plan may on first inspection appear complicated, experience has proven it to be productive of excellent results and, in the long run, economical and timesaving.

External infections

1. Clinical observation. The clinical impression is of the utmost importance in choosing the proper chemotherapeutic agent for initiating treatment. The alert physician will note distinctive signs such as: chemosis of the bulbar conjunctiva, which is an early sign of gonococcic conjunctivitis; petechial hemorrhage involving the bulbar conjunctiva, which indicates infection with H. influenzae or the Koch-Weeks bacillus (however, it must be remembered that pneumococcic conjunctivitis may also show small, subconjunctival hemorrhages); marginal corneal infiltrates or punctate epithelial staining with symptoms of pain especially in the morning, which suggests staphylococcic conjunctivitis; angular inflammation in blepharoconjunctivitis, which indicates infection with the Morax-Axenfeld bacillus; and, finally, blepharitis with the formation of adhesive scales on the lids, ulcers at the bases of the cilia, and meibomitis, which indicate infection with staphylococcus.[13]

2. Bacteriologic diagnosis. Prior to the institution of therapy, material is removed from the infected conjunctiva or skin of the lid for bacteriologic and cytologic studies.

Cytologic preparations. Smears are stained with the Giemsa stain and examined for: polymorphonuclear cells, usually indicating bacterial infections; lymphocytic cells, suggesting a virus infection such as epidemic keratoconjunctivitis, herpes simplex, or molluscum contagiosum; eosinophilia, indicating conjunctival allergy; and inclusion bodies, indicating trachoma or inclusion conjunctivitis (the former being distinguished by the presence of clumps of cell debris and large macrophages (Leber cells) in material expressed from the follicles).[14]

Bacteriologic preparations. Another smear is prepared with Gram's stain and is examined for bacterial organisms, which are readily recognized as being either Gram-positive or Gram-negative.

3. Cultures and sensitivity tests. Cultures are made to aid in the bacteriologic diagnosis, and sensitivity tests are performed to check on the susceptibility of the organism to the chemotherapeutic agent used in initiating treatment.

Material from the conjunctival sac, or preferably from the area of greatest inflammatory intensity, is removed with a swab

which is then immersed in brain-heart broth and incubated for from 4 to 5 hours. At the end of this time, the swab is removed from the broth culture and is used to streak two blood agar plates. On the second of these plates, suitable concentrations* of the important antibiotics are placed in small glass cylinders. Within 18 to 24 hours, the organisms are isolated and, at the same time, information is available as to their sensitivity to the more important chemotherapeutic agents.

* Penicillin, 0.1 unit per cc.; aureomycin, 5 μg. per cc.; streptomycin, 2.5 μg. per cc.; bacitracin, 2.5 μg. per cc.

Equipped with the essential clinical and laboratory findings, the physician can now plan a regimen that will be maximally effective for each patient. The following example will demonstrate the procedure in management.

If the clinical impression is that of an acute external ocular infection, epithelial scrapings are placed on slides for cytologic and bacteriologic study and swabbings from the conjunctiva are immersed in brain-heart broth to be later streaked on blood agar plates. When facilities are available, the smears are stained and examined immediately, and the results obtained, along with the

TABLE 1

A GUIDE FOR THE TREATMENT OF EXTERNAL OCULAR INFECTIONS

Disease	Etiology	Drug of Choice in Order Named	Method of Administration	Dosage
Infection of Skin of Lids and Lid Margins				
Pyogenic dermatoses	Streptococcus	Sulfadiazine	Local*	5% ointment
	Staphylococcus	Sulfathiazole	Local	5% ointment
	Mixed infections	Bacitracin	Local	1,000 μg per gm. of ointment
		Penicillin	Local	1,000 to 100,000 units per cc. or gm.
Furunculosis Lid abscess	Staphylococcus	Multiple Sulfonamides	Oral	Initial dose 4 gm. 1 gm. q 4 to 6 hr.
Erysipelas	Streptococcus	Sulfanilamide	Oral	1 gm. q 4 to 6 hr.
Blepharitis (staphylococcic type)	Staphylococcus	Sulfadiazine	Local	5% ointment
Bacterial Infections of Conjunctiva and Cornea				
Hyperacute inflammations	Gonococcus	Penicillin	Local	10,000 units per cc.†
	Meningococcus	Sulfadiazine	Local	5% sol. or oint.
	Pneumococcus	Sulfacetamide	Local	30% sol./10% oint.
Acute or subacute inflammations	Streptococcus	Sulfadiazine	Local	5% sol./5% oint.
	Staphylococcus	Bacitracin	Local	1,000 μg. per cc. or gm.
	H. influenzae H. conjunctivitis (Koch-Weeks)	Streptomycin	Local	10,000 μg. per cc. or gm.
	H. lacunata (Morax-Axenfeld)	Aureomycin	Local	0.5% to 1.25% solution
	Coliform group B. proteus Ps. aeruginosa	Chloramphenicol	Local	1% solution
Membranous inflammations	C. diphtheriae	Streptomycin	Local	10,000 units per cc. or gm.
		Sulfadiazine	Local	5% sol. or oint.
		Penicillin‡	Local	10,000 units per cc.
	Streptococcus	Penicillin	Intramuscular	50,000 units q 2 hr.
		Multiple sulfonamides	Oral	4 gm. initial dose 1 gm. q 4 to 6 hr.
Chronic inflammations	H. lacunata (Morax-Axenfeld)	Sulfacetamide	Local	30% sol. or 10% oint.
		Streptomycin	Local	10,000 μg. per cc. or gm.
	Staphylococcus Pneumococcus	Aureomycin	Local	0.5% to 1.25% solution
		Sulfadiazine	Local	5% sol. or 5% oint.
		Dihydrostreptomycin	Intramuscular injection	1 to 2 gm. per day
Oculoglandular tularemia	B. tularensis	Streptomycin	Intramuscular injection	} to 1 gm. per day
		Aureomycin	Oral	0.25 to 0.5 gm. q 4 to 6 hr.
Virus Infections of Conjunctiva and Cornea				
Epidemic keratoconjunctivitis Herpes simplex Molluscum contagiosum		Aureomycin	Local	0.5% to 1.25% solution
Lymphogranuloma venereum ophthalmitis		Sulfacetamide	Local	30% sol. or 10% oint.
		Aureomycin	Oral	0.25 to 0.5 gm. q 4 to 6 hr
		Dihydrostreptomycin	Intramuscular injection	1 to 2 gm. per day
		Streptomycin	Intramuscular injection	} to 1 gm. per day
Trachoma Inclusion conjunctivitis		Sulfacetamide	Local	30% sol. or 10% oint.
		Sulfadiazine	Local	5% sol. or oint.
		Multiple sulfonamides	Oral	4 gm. initial dose 1 gm. q 4 to 6 hr.

* Local applications are made every 2 to 4 hours except in gonorrheal ophthalmia.
† In gonococcic conjunctivitis instillations are made every 2 to 5 minutes until discharge ceases. This is followed by drops every 30 minutes for 12 hours and then every 1 to 2 hours for an additional 24 hours.
‡ Penicillin is an adjuvant to diphtheria antitoxin.

clinical impression of the causative organism, determine the choice of chemotherapeutic agent.

If Gram-positive organisms or Gram-negative cocci are found, the drugs of choice for initiating treatment are sulfonamides and bacitracin, except in gonococcal infection for which penicillin is the drug of choice as shown in Table 1. If Gram-negative rods are found (such as one of the Hemophilus group, E. coli, or B. proteus), streptomycin, aureomycin, or chloramphenicol is indicated at the beginning of treatment. When facilities for immediate examination of smears are not available, the choice of a chemotherapeutic agent depends entirely upon the clinical impression of the causative organism. In 18 to 24 hours, the additional information concerning the type and the sensitivity of the organism becomes available at which time therapy may either be changed or continued depending upon these findings.

Suppose, for example, the original impression was that of a staphylococcic infection and the patient was initially treated with sulfacetamide as recommended in Table 1. Twenty-four hours later, however, the laboratory reports confirm the presence of a Staphylococcus aureus but finds this organism to be very sensitive to bacitracin and relatively insensitive to sulfacetamide. The sulfacetamide should then be discontinued and bacitracin therapy instituted.

Herpetic infections and epidemic keratoconjunctivitis are usually sufficiently distinctive clinically so that aureomycin will have been given initially, and this agent is of course continued in spite of negative bacteriologic findings.

TABLE 2

A GUIDE FOR THE TREATMENT OF UVEITIS, ORBITAL CELLULITIS, AND OPTIC NEURITIS

Disease	Etiology	Drug of Choice in Order Named	Method of Administration	Dosage
Uveitis (granulomatous)				
Syphilis	Spirocharta pallida	Penicillin	Intramuscular	50,000 units q 2 hr. for 96 injections*
Tuberculous	M. tuberculosis	Dihydrostreptomycin	Intramuscular	1 to 2 gm. per day†
		Streptomycin	Intramuscular	0.5 to 1 gm. per day†
		Aureomycin	Oral	2 to 6 gm. per day for 2 weeks
Brucellosis	Brucella	Dihydrostreptomycin	Intramuscular	1 to 2 gm. per day
		Streptomycin	Intramuscular	0.5 to 1 gm. per day
		Aureomycin	Oral	0.25 to 0.5 gm. q 4 to 6 hr.
Lymphogranuloma venereum	Virus	Dihydrostreptomycin	Intramuscular	1 to 2 gm. per day
		Streptomycin	Intramuscular	0.5 to 1 gm. per day (combined with multiple sulfonamides orally)
Uveitis caused by pyogenic organisms				
Acute purulent inflammations Subacute inflammations Chronic inflammations	Streptococcus Pneumococcus Meningococcus Staphylococcus Gonococcus	Penicillin	Intramuscular Intravitreal injection	50,000 units q 2 hr.‡ 1,000 units
		Multiple sulfonamides	Oral	4 gm. initial dose 1 gm. q 4 to 6 hr.
	Staphylococcus	Penicillin	Intramuscular	50,000 units q 2 hr.‡
Orbital cellulitis	Streptococcus Pneumococcus	Multiple sulfonamides	Oral	4 gm. initial dose 1 gm. q 4 to 6 hr.
	Streptococcus	Penicillin	Intramuscular	50,000 units q 2 hr.‡
Optic neuritis (infectious type)	Pneumococcus Staphylococcus	Multiple sulfonamides	Oral	4 gm. initial dose 1 gm. q 4 to 6 hr.
	Spirochaeta pallida	Penicillin	Intramuscular	50,000 units q 2 hr. for 96 injections*
	M. tuberculosis	Dihydrostreptomycin Streptomycin	Intramuscular Intramuscular	1 to 2 gm. per day† ½ to 1 gm. per day†

* Course is repeated if necessary along with arsenic, bismuth and fever therapy.
† Combined with one of the following: promin 0.8 gm., promizole 10 to 16 gm., or para-aminosalicylic acid 10 to 20 gm. per day.
‡ To maintain a high blood level the administration of repository penicillin or caronamide is required.

Deep infections

Regarding deep infections of the eye where isolation of the organism is either difficult or impossible, the plan already mentioned must be modified. The selection of the proper chemotherapeutic agent to be employed depends upon the diagnosis as derived from history, clinical observation, and laboratory tests. Thus, the presence of mutton-fat deposits on the posterior surface of the cornea is indicative of one of the granulomatous inflammations. In this group

of diseases, diagnosis is aided by laboratory tests, such as the Kahn test for syphilis, agglutination test for brucellois, tuberculin tests for tuberculosis, and the Frei test for lymphogranuloma venereum. X-ray studies may reveal the presence of old tuberculous infection or the characteristic findings of sarcoidosis. The choice of chemotherapeutic agent for this group of diseases, including orbital cellulitis and infectious optic neuritis, is listed in Table 2.

In the nongranulomatous inflammatory diseases of the eye, a search should be made for foci of infection. Bacteriologic studies should be performed on material obtained from the tonsils, teeth, prostate, and stools. When organisms are isolated, the choice of drug is indicated in Table 2.

Many types of uveal inflammation are, however, of obscure or nonbacterial origin and do not respond to chemotherapy. Recently new agents have become available which hold forth great promise in these diseases. Of particular interest are certain products of the adrenal cortex and the adrenocorticotropic hormone of the pituitary which have been employed and found to be effective in nongranulomatous types of anterior and posterior uveitis. These findings must be regarded as yet in the experimental stage.

Conclusions

The latest developments in the treatment of ocular infections have been reviewed and a rational approach to the treatment of such infections has been offered.

The importance of accurate bacteriologic diagnosis as a preliminary to good therapy is stressed. However, in acute infections the physician should initiate therapy immediately and not await the laboratory report.

The ophthalmologist should maintain a flexible therapeutic attitude to the problem of ocular infections so that treatment can be altered readily if laboratory findings or the course of the infection so indicate.

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CLINICAL EXPERIENCES WITH VITREOUS REPLACEMENTS*

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The history of vitreous surgery has been thoroughly reviewed by Cutler, Fritz, Gartner and Priestly, and Katzin and Blum. In summarizing we can say that vitreous surgery has been done for over 50 years. Replacement of vitreous with spinal fluid was first done 20 years ago by Hegner, who reported his results to the German Ophthalmological Society in 1929. Cutler was the first to replace vitreous with vitreous from another eye. All other authors replaced the vitreous with saline solution.

It is not surprising that the spinal fluid is so well tolerated in the human eye. The similarity in the chemistry and physical aspects of the spinal fluid, vitreous, and aqueous is striking and was already known to Schwalbe in 1872. Wessely reëmphasized this fact in 1908. Magitot and Mestrezat consider the aqueous, the spinal fluid, and the fluid in the inner ear (semicircular canal), which they call "nerve protecting fluids," to be almost identical and emphasize that the eye and the ear are sensory organs. They develop from an evagination of the primitive brain and, for this reason, they contain almost identical fluids.

The following table taken from *Kurzes's Handbook on Ophthalmology* explains this fact very well:

	Aqueous	Vitreous	Liquor
1. Specific gravity	1.0077%	1.0075%	1.0076%
2. Freezing point	−0.575°	−0.575°	−0.576°
3. Dry matter (ashes)	1.12%	1.13%	1.09%
4. Nitrogen	0.023%	0.024%	0.023%
5. Sodium Chloride	0.73%	0.73%	0.73%
6. Sugar	0.075%	0.062%	0.053%

Recently, Fritz replaced vitreous with spinal fluid in four patients.

My experience in replacement of the vitreous is limited to six human eyes. Although the results are not spectacular, I think they are interesting enough to be reported here. In two of the cases, I replaced the vitreous with vitreous from another eye. In three, the vitreous was replaced with the patient's own spinal fluid and in one, with saline solution.

CASE REPORTS

CASE 1

History. My first experience with replacement of the vitreous was in a 40-year-old Filipino who had suffered from repeated intraocular hemorrhages, probably due to Eales's disease, since 1934. The patient told me during his first visit on June 10, 1946, that he lost the sight in his left eye in 1934 within 10 months after the onset. He had a history of lues which had been treated the year before, in 1945. His last spinal and blood Wassermann were negative. The Mantoux test was positive in a dilution of 1:1,000. I treated the man with tuberculin injections, calcium gluconate, and vitamin K by mouth.

In August, 1946, three months later, vision in the right eye had improved from hand motion to finger counting within five feet. The left eye never showed any improvement. He had good light perception but the projection was uncertain when the source of light came from the nasal side.

Eye examination. The right eye was externally negative and the lens clear. There were fresh bloody vitreous opacities and old retinal scars. The optic disc was poorly outlined and the retinal vessels were surrounded by connective tissue.

The left eye was also externally negative but had a posterior cortical cataract through which one could see large brownish vitreous floaters and scars. Posterior cortical cataracts are a common occurrence in eyes with old dense vitreous opacities.

I told the patient that the vision in his right eye, which was finger counting at five feet then, might improve some more but, in the left eye, which never had more than light perception for over 12 years, no improvement could be expected. I told him about the possibility of a vitreous transplant and, because of the contemplated unusual surgery, asked him to consult with Dr. Irvine, who agreed with my opinion. The operation was performed on September 6, 1946. Since the patient also had the usual posterior cortical cataract, he was advised to have it removed at the same time.

The operation was as follows: Novocain (four percent) was injected around the orbital rim and

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one cc. of novocain was injected behind the globe. Fixation sutures were placed through the superior rectus muscle. Two corneal scleral mattress sutures were placed. A limbal incision was made with a Graefe knife and was enlarged with the scissors. An iridectomy was done. The lens was removed with the loop.

The rather fluid vitreous was permitted to run out through the incision. Actually I helped the vitreous escape by putting my loop through the wound in the center of the eye making forward motions toward the front of the eye.

The two mattress sutures were closed tight. The iris pillars were replaced and the vitreous from a cadaver eye was injected into the posterior chamber. Two additional sutures were brought through the wound. Since the eye did not seem quite firm enough, I injected one cc. of air into the globe. The patient remained in the hospital for 10 days.

Postoperative course. When he came to my office on the 12th day, the anterior chamber was still shallow. He was told to go to bed with both eyes bandaged. The wound leaked for quite a while. During this period I occasionally touched the wound with trichloracetic acid.

In February, 1947, when I tested him for glasses he was able to see 20/400 with a +10.0D. lens. This improvement is quite remarkable since the man was not even able to see hand motion before the operation and his light projection had been faulty from the nasal side.

With the ophthalmoscope one was able to make out the optic disc and the retina. It showed connective-tissue strands which usually followed the blood vessels. There were still some connective-tissue strands present in the vitreous but, as a whole, the vitreous was fairly clear. The vision stayed 20/400 up to his last visit in October, 1947. This was 11 months after surgery.

CASE 2

History. My second case was that of a man, aged 40 years. He had been hit in his left eye during a fist fight just a year before he came to me. Although the patient had noticed that his vision had become very cloudy shortly after he received the blow, it had actually become noticeably worse in the two months previous to his first visit. He said he noticed a "milky film" over his left eye.

I found his right eye to be perfectly healthy with vision of 20/20 without glasses. Vision in the left eye was finger counting just in front of the eye. After dilation of the pupil, I found the anterior segment of the eye to be normal, a clear lens, and small grayish-brown vitreous opacities in the anterior vitreous which was comparatively clear. The posterior vitreous showed white dense masses which covered and surrounded the optic disc, particularly above. In that area I thought I could also make out fresh hemorrhages. This was in September, 1946.

A general physical examination was completely negative. A Mantoux test with tuberculin in a dilution of 1:1,000 was not convincing. While I was in the hospital recovering from an accident, the patient was seen by another doctor who prescribed iodine internally.

I saw the patient again four months later, in January, 1947. At that time the vitreous was completely cloudy and the vision was reduced to hand motion just in front of the eye. This was 16 months after the original accident. A vitreous transplantation was advised and the patient was told about the risk this operation involved.

The vitreous transplantation was performed on January 25, 1947, under local anesthetic. The patient received the usual akinesia by injection of two-percent novocain around the orbital rim. One cc. of novocain was injected behind the globe. Three cc. of vitreous were aspirated from a cadaver eye which was received from the Estelle Doheny Eye Foundation. The donor had died three hours previously from a heart attack.

Two cc. of magenta-colored vitreous was aspirated from the recipient's eye through an 18-gauge needle which was thrust into the vitreous 10 mm. behind the limbus through the pars plana of the ciliary body. The aspiration of the vitreous was not as easy as I thought it would be. I had to use quite a bit of force to overcome the negative pressure. As I know now, too much force was probably used because the aspirated vitreous which appeared in the syringe after the first 1.5 cc. had been removed, was bloody in color. I had the feeling at the end of the operation that it would have been better if I had been satisfied with one cc. instead of two cc.

The syringe, which was filled with the patient's cloudy vitreous was replaced by another syringe which had the clear vitreous of the donor's eye, and two cc. were injected into the patient's eye. Conjunctiva was sewn over the wound.

When the patient left the hospital five days later, he could still see hand motion but the vitreous was cloudy and the eye showed marked pericorneal injection which gradually disappeared. During the third month of recovery, precipitates appeared in the anterior chamber and a whitish-yellow mass could be seen in the vitreous. The eye as a whole appeared smaller. The precipitates disappeared during the fourth month and the anterior chamber became clear again but the eyeball itself had shrunk. During the seventh month the patient was advised to have his eye removed, which I did in August, 1947. A plastic implant was put into the socket and the muscles were attached to it.

Comment. The history of this case and its unfortunate outcome made it clear that one has to avoid using force in the removal of the vitreous. It occurred to me that any operation for replacement of the vitreous would be safer if no suction was used; simply make the incision, as I did in the first

case, and just let the vitreous run out. The danger of a secondary hemorrhage should be decidedly less if this technique was used.

CASE 3

History. The third case is that of a 58-year-old diabetic who was also a hypertensive patient. I met him on March 12, 1948. He told me that he had suddenly lost the sight in his left eye two years before without any pain or warning and that an eye specialist whom he had consulted told him he had a vitreous hemorrhage. At the time of his first visit he was rapidly losing vision in his better right eye. He took 15 units of insulin daily and his blood pressure was 180/100 mm. Hg.

Eye examination. I found both eyes to be externally normal, and the pupils reacted to light. The right lens was clear and the vitreous showed many dark-brown vitreous floaters. The left lens showed posterior cortical opacities, which is to be expected in an eye with an opaque vitreous of long standing. The vitreous itself was completely dark and no details could be seen. The intraocular pressure was 20 mm. Hg (Schiøtz).

The vision in the right eye was 20/200; in the left eye, prompt light perception, but the projection was faulty. The patient was able to see the light with his left eye no matter where I held it but he always projected it to the temporal side.

Rutin tablets and vitamin K were prescribed and he was advised to eat seafood and citrus fruit.

The right eye, in which the man had the fresh hemorrhage, cleared up rapidly, in two and one-half weeks. The vision improved to 20/40 in that eye but the left eye did not change.

I told the patient that I believed his left eye, which had had no sight for over a year, would not improve and advised him to have a vitreous replacement with spinal fluid. I also advised the removal of the lens at the same time, since it showed opacities in the posterior cortex.

In other words, I proposed the same operation as in Case 1, with the exception that my intention was to replace the cloudy vitreous with spinal fluid instead of vitreous from another eye.

The operation was done April 7, 1948. A spinal tap was performed and four cc. of spinal fluid were withdrawn. The patient was put on his back and four-percent novocain was injected around the orbital rim and retrobulbar injection of four-percent novocain (one cc.) was given. A superior rectus suture was used. Two corneoscleral mattress sutures were placed at the 11- and 1-o'clock positions.

A limbal incision was made with a Graefe knife and enlarged with the scissors. Iridectomy was done at the 12-o'clock position. The lens was delivered with Arruga's forceps. About half of the vitreous was gently expressed out of the eye.

As the vitreous fluid escaped, it was noted that the fluid part of the vitreous was comparatively clear but that brownish elongated cysts filled part of the vitreous cavity. These elongated cystic strands were somehow suspended in a vertical direction but did not seem to want to come out through the wound. I picked them up one by one, as many as I dared to, considering always the possibility of producing a detachment, until the vitreous seemed quite clear to me. I tied the preplaced sutures and injected three cc. of spinal fluid into the vitreous cavity. The wound was closed with three additional sutures. Atropine was instilled and both eyes were bandaged.

Postoperative course. The man stayed 10 days in the hospital with both eyes bandaged. The dressing was changed about every other day. The recovery was uneventful and the pericorneal injection gradually subsided. The patient was examined the first time in my office about two weeks after surgery. I could see a clear tunnel in the posterior chamber through which I was well able to make out the optic disc. On each side of the tunnel these brownish cysts or strands could still be noticed. They looked somewhat like a curtain on each side.

Two months after the operation the vision had improved to 20/40 with a +9.5D. sph. ⊃ +1.75D. cyl. ax. 10°. All of this time I kept the patient on calcium lactate, rutin, vitamin K, and iodine internally.

The patient was demonstrated during a surgical clinic I held for the American College of Surgeons on October 20, 1948, in Los Angeles. The man was able to read newspaper print for the visiting surgeons with a cataract lens. These doctors could also notice this peculiar clear tunnel in his vitreous cavity which represented the space from which I had removed the cystic opacities or strands that were probably caused by previous hemorrhages.

Outcome. Unfortunately, the patient was so elated about his vision that he paid little attention to his diet and mode of living. On January 4, 1949, seven months after the operation, he came in with a fresh hemorrhage which cleared up sufficiently in three weeks to enable him to get 20/60 with a cataract lens. After another month, the man was involved in a car accident and developed the second hemorrhage since operation. He came to the office on February 21, with a three-mm. hyphemia in the anterior chamber and a cloudy vitreous. The intraocular pressure was increased to about 40 mm. Hg (Schiøtz). The blood sugar was 291 mg. per 100 cc., his blood pressure was high, and he had a slight polycythemia.

Comment. Let us hope the hemorrhage will clear up again. Even so, I believe this to be a very instructive case since that eye had regained 20/40 vision after having had only faulty light projection for two years. This improvement of vision was maintained for almost eight months until a new hemorrhage arose. It shows that it is important to impress on the patient that a vitreous replacement might restore the vision but will never remove the underlying cause.

CASE 4

History. The fourth case is that of a diabetic woman, aged 60 years, whose diabetic history covered several years, during which period she had suffered recurrent vitreous hemorrhages. She was receiving blind aid from the state of California at the time of my first examination on June 30, 1947.

Eye examination. At that time the patient showed incipient posterior cortical cataracts in both eyes. Connective-tissue strands and fresh hemorrhages could be seen in the vitreous of the right eye. I was barely able to make out the outline of the optic disc. The vitreous of the left eye was completely dark. Vision in the right eye was 20/400 with correction; the left eye had poor light projection.

The patient was very anxious to have something done to improve her sight and I told her about the possibility of improving the vision in her poorer left eye by doing a replacement of vitreous.

The operation was done on October 20, 1948, during a surgical clinic of the American College of Surgeons in Los Angeles. The patient received an injection of novocain around the orbital rim and 1.5-percent novocain was injected behind the globe.

An incision was made with the cataract knife at the limbus. The incision was enlarged with the scissors to about 12 mm. Three corneoscleral sutures were put in. An iridectomy was performed and the lens was extracted in the capsule.

Fluid vitreous, which again was not as cloudy as one would expect, escaped. Some more vitreous was removed with gentle massage from below. Cloudy vitreous strands were grasped with Arruga forceps. More than half of the vitreous was emptied in this manner. The sutures were tied and three additional sutures were put in. The eyeball was filled with spinal fluid which had been removed just before the surgery. The eyeball had normal shape at the end of the operation. Atropine was instilled and both eyes were bandaged.

Postoperative course. The eye recovered very well from the operation and the eyeball hardly showed any injection after six weeks. The intraocular pressure was 20 mm. Hg (Schiøtz) at that time. The vitreous, however, never cleared up although the patient claimed she could see the light better than before. This I could verify because her light perception was prompt now, as well as correct. Glasses did not help. She still has her diabetes but has not had any fresh hemorrhages since the surgery.

CASE 5

History. The last case is that of a 46-year-old woman from Mexico City who had nuclear cataracts in both eyes and retinitis pigmentosa in rather advanced stages. The nuclear cataracts were markedly developed and just showed clear lens matter in the periphery through which one could see the details of the retina. The optic discs were wax colored and well outlined. The blood vessels were extremely thin and were surrounded by pigment changes, particularly in the periphery. The vitreous was clear but completely fluid in both eyes. I also examined her son who had clear lenses. He also had retinitis pigmentosa.

Vision in the right eye of the patient was finger counting at one foot and, in the left eye, finger counting at four inches but only in the upper field. In other words, when she wanted to see the fingers the patient had to look down.

The patient had consulted several oculists before coming to me, none of whom had encourged her to have her cataracts removed, I suppose because of the retinitis pigmentosa and fluid vitreous. I told her she might submit her worse left eye to a cataract operation, since I have had good results in two other cases of cataract extractions complicated by retinitis pigmentosa.

The cataract operation was performed on August 4, 1948. There was a great deal of fluid vitreous lost. Some of it came out right after the incision. An iridectomy was performed. The cataract was extracted in the capsule with the loop, because the lens had a tendency to fall back into the fluid vitreous. Two corneoscleral sutures, which had been put in previously, were tied, and three additional sutures were put in. The eyeball, which was completely collapsed by this time, was filled up with saline solution.

Postoperative course. The patient's recovery in the hospital was uneventful. The day after she left the hospital, a hemorrhage developed in the anterior chamber. When I saw her at home, I noticed a two-mm. hyphemia. This hemorrhage cleared up in three days, after bed rest and the bandaging of both eyes.

Two months after the operation, the anterior chamber and the vitreous were completely clear and the patient was able to count fingers at four feet with her cataract glasses. This was an improvement over finger counting in front of the eye at four inches before the surgery.

Even now, the patient sees best when she looks down. I could explain this very easily at this time since her medias were completely clear and I was able to see degenerative changes in the macula itself. Nevertheless, she was satisfied with the result.

Second operation. I operated the better right eye on October 13, 1948. This was the eye which had finger counting at one foot distance before surgery.

In view of the experience with the previous operation on the left eye, I expected again an extensive loss of vitreous and had a spinal tap done just before the operation. I made an incision with the cataract knife. Two corneoscleral mattress sutures were put in but not tied. An iridectomy was performed. An attempt was made to deliver the lens with Arruga forceps but I was unable to get hold of the lens because it showed a tendency to slip away into the vitreous. I then delivered the cataract with the loop. About a teaspoonful of completely fluid vitreous was lost during this procedure. The two corneoscleral sutures which were put in previously were tied and two additional sutures were put in.

The spinal fluid, which had been tapped before surgery, was used to replace the lost vitreous. About two cc. were injected into the eye. Atropine was instilled and both eyes were bandaged. The wound

was dressed about every other day, and the patient remained in the hospital for 10 days.

Postoperative course. Six weeks after surgery when I refracted the patient, her vision was 20/80 with cataract glasses. It improved to 20/70—1, two weeks later. The glasses were then prescribed. This is to be compared with finger counting before surgery.

It was very interesting to notice the behavior of the two eyes. As you remember, spinal fluid replaced the lost vitreous in the right eye and saline solution replaced the lost vitreous in the left eye. While the recovery in the right eye was entirely uneventful, the left eye, which had been filled up with saline, developed a two-mm. hyphemia on the 10th day.

About four months later the intraocular pressure in the left eye went up and stayed up in spite of the use of miotics until a cyclodiathermy was done which lowered the pressure to 30 mm. Hg (Schiøtz). The tension in the right eye has always stayed between 18 and 24 mm. Hg.

As far as the clearness of the posterior chamber was concerned, I could not see any difference between the right posterior chamber which was filled with spinal fluid, and the left posterior chamber which was filled with saline solution. In both cases they were perfectly clear and the fundi showed the signs of retinitis pigmentosa, which could be seen just as clearly as in any aphakic eye after intracapsular cataract extraction.

I do not know if the spinal fluid in the right eye had a beneficial effect, but there were no complications in the recovery of the right eye, while the left eye developed a secondary glaucoma which persisted until surgical interference.

Summary and Conclusions

If I may draw any conclusions at all from my limited experience, I might say that both vitreous and spinal fluid are well tolerated in the human eye. The eye of the first patient (Case 1), the patient with Eales's disease, in which the vitreous was transplanted with vitreous from another eye, did not show any undue reaction. The vision, which recovered to 20/400 from poor light projection, is all one could possibly expect from this eye in view of the fundus changes caused by long-standing Eales's disease.

The fact that patient in Case 2, whose vitreous was replaced with vitreous, lost the eye can certainly not be blamed on the transplanted vitreous but is undoubtedly due to an extensive hemorrhage which followed my surgical procedure.

Regarding the third case, in which the vitreous was replaced with spinal fluid, the diabetic patient had a cloudy vitreous for two years and recovered sight to 20/40. The fact that the man suffered other vitreous hemorrhages, after having a clear eye for eight months after surgery, is easily explained by the fact that he still had diabetes which he liked to ignore in his diet. The last blood-sugar count was 290 mg. per 100 cc., with increased blood pressure. In other words, the vitreous replacement helped him but it did not eliminate the possibility of new hemorrhages.

In Case 4, the diabetic patient certainly did not lose anything because of vitreous replacement. Light perception, faulty before operation, is now correct.

Considering the patient in Case 5, the woman who came from Mexico City, in whom the clear vitreous of one eye was replaced by saline solution and in the other eye by spinal fluid, we can see that the eye whose vitreous was replaced by spinal fluid stood the operation better. Her vision is still 20/70, eight months after surgery, which is all that can be expected in an eye with advanced retinitis pigmentosa.

As far as the technique is concerned, there is one thing I learned from my experience and that is—it is extremely important not to use any force to overcome the negative pressure when you try to get out the vitreous, as happened in Case 2.

For this reason it seems to me that making an incision, as was done in the other cases, and just letting the vitreous run out is probably as safe a procedure as any on the eye, provided you have good closure of the wound. It has the additional advantage that organized vitreous opacities can be removed with this open technique, opacities which can never be removed by means of a needle and syringe.

Since most of the patients who have dense vitreous opacities of long standing also have posterior cortical cataracts, I feel one is justified in removing the lenses at the same time.

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Discussion

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It has been my privilege to examine the postoperative results of one of the patients in whom Dr. Landegger has successfully replaced a hemorrhagic vitreous by spinal fluid. Also, I had the opportunity to observe his technique in another case.

Animal experimentation has shown that the outcome of vitreous replacement depends upon three main considerations: firstly, the presence or absence of pathologic changes in the vitreous itself; secondly, the type of material used to replenish the vitreous cavity; and thirdly, the operative technique followed.

The first consideration is of interest in human surgery. We all know that the loss of vitreous in a young patient is readily replaced and that the late visual results are often excellent. Unfortunately, we know equally well the great disasters which follow the loss of a pathologic prolapsed vitreous. Excepting the rare cases following perforating traumas, our attempts in vitreous replacement will deal with pathologic changes well exemplified by the operations on six eyes in five patients just reported by Dr. Landegger.

So far as replacement material is concerned, the communication of Dr. Landegger is unique in reporting cases in which all the available replacement fluids have been used. In one case, physiologic saline solution filled the eye after aspiration of the cloudy vitreous; in two cases, vitreous transplant from a donor eye was used; and finally, in three cases, spinal fluid forced the eyeball to resume its spherical shape.

The experiments of Blum and Katzin have shown that the injection of saline is far from being a harmless procedure. True vitreous transplants are successful, although the progressive integration of the donor vitreous into the host vitreous is slow and accompanied by physicochemical reactions inherent to the fact that the material is foreign although homologous. Spinal fluid appears to be especially suited for vitreous replacement, as has been pointed out by Dr. Landegger.

As to techniques, it is important to note that the more successful cases are those in which the vitreous has been allowed to "flow" out rather than being aspirated. The original anterior approach of Dr. Landegger's, after the removal of the lens, is to be recommended as the lens often becomes cloudy or dislocates posteriorly. Posterior segment approach necessitates additional perforations which may cause hemorrhages, retinal separations, or late staphylomas.

It requires courage to report results from a procedure which appears to be a bold one, but I am thoroughly convinced that, even if limited, the results justify all the attempts. I examined Case 3 and listened to the patient's own history. The improvement, from a mere perception of light with uncertain projection, to a corrected visual acuity of 20/40, is indeed remarkable. In this case, ophthalmoscopically the central portion of the media was perfectly clear and a funnel-shaped, enlarged canal of Cloquet was demonstrable. Through it, the disc and the macular area were clearly visible. Around this tunnel, the vitreous (alternately dark or milky) was suggestive of what the whole cavity must have looked like prior to operation. It is certainly not a faulty technique which jeopardized the final results; diabetes was causing continued and more destructive lesions.

We are indebted to Dr. Landegger for bringing forth his clinical experiences with vitreous replacements. We realize that these methods are justifiable whenever possible, provided we thoroughly acquaint the patient and the family with the hazards and dangers of the operation.

APPARENT ACCOMMODATION IN APHAKIC EYES*

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On rare occasions in the practice of ophthalmology, one sees aphakic patients who are able to read small type at the usual reading distance while wearing only their distance correction. An adequate explanation of this phenomenon has never been given, although many theories have been advanced.

I had the opportunity to study in some detail an intelligent patient who was aphakic in both eyes and was able to read with ease with only his distance correction. Although I am still unable to offer an adequate explanation for this phenomenon, a number of the old theories have been definitely ruled out and some deductions may be drawn relative to the possible mechanism of the apparent accommodation.

Before presenting the details of the case about to be reported, the literature will be briefly reviewed and the theories which attempt to explain this phenomenon will be considered.

Many excellent ophthalmologists have believed that some form of accommodation in the aphakic eye actually exists; included in this group were von Graefe, Jaeger, Loring, Silex, Förster, and Woinow. Other excellent men have taken the opposite view, among them being Helmholtz, Donders and Manhardt.[1]

Theories of phenomenon

The theories advanced to explain apparent accommodation in the aphakic eye have been the following:

1. The patient slides his distance correction down on his nose or looks through the periphery of the lens. This theory can

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definitely be ruled out at once, since too many of these patients have been carefully observed under conditions in which it has been impossible for them to move their spectacles down on their noses or to look through the periphery of the lens in reading.

2. The ordinary aphakic correction magnifies the image. As an example, a lens of approximately +13.0 diopters' power placed one-half inch before the eye produces a magnification of one and one-third times. As the result of this magnification, an aphakic patient who reads J1 only needs the acuity that an unoperated patient needs in order to read J2 or slightly larger print.[1]

3. Some aphakics are actually able to see 20/10 at distance and consequently would be able to read type smaller than J1 if it were in perfect focus.

4. The patient may be able to select certain rays along the caustic of light or to interpret diffusion circles.

5. Small pupils in some patients may actually produce a pinhole effect.

6. The refractive power of the cornea may be changed through a change in the shape of the cornea, either from lid pressure, compression of the eyeball by the external ocular muscles, or contraction of the ciliary musculature.

7. There may be changes in the face of the vitreous, with or without the presence of lens capsule.

8. Contraction of the ciliary musculature and/or of the extraocular muscles may increase the anteroposterior diameter of the eyeball.

9. It has been suggested that the retina is pulled forward. (Even if this were true, it would serve to increase the difficulty and not decrease it.)

Survey of literature

A survey of the literature discloses that a number of cases of apparent accommodation in aphakic eyes have been reported. Davis,[1] in 1895, reported a 42-year-old patient who was able to see 20/10 at distance and J1 from 22.5 to 8 inches from his eyes with only his distance correction. It is particularly noteworthy that Davis states that this patient's pupil was 3.5 by 7.0 mm. in size and that the pupil was entirely free from membrane.

Loring[1] reported an 18-year-old patient with round, clear pupils who was able to read 20/20 at distance and J1 from 20 to 5 inches from his eyes. The size of the pupils was not stated.

Davis, in 1919, presented a patient, aged 73 years, whose distance visual acuity was 15/30 and who was able to read J1 from 13 to 7 inches from his eye with only his distance correction.

Horton,[2] in 1929, reported a patient, aged 60 years, whose distance visual acuity was 6/12 (20/50) and reading acuity J1 with only the aphakic correction.

Also in 1929, Israel[3] presented a 14-year-old patient with 20/15 distance acuity and J1 from 18 to 9 inches from his eyes. Israel mentioned that this patient had a small opening in his capsule, although the pupil was three mm. in diameter. Israel was able to rule out ciliary accommodative power by atropinizing the eye, and noted no change in keratometer measurements or ophthalmoscopic examination while the patient was fixating at the near point.

Hoare[4] wrote that it was quite common to find young aphakics reading with their distance lenses. He stated that children operated upon for congenital cataracts could be taught to read without a reading addition. Hoare's case reports were not striking since his patients read print of the order of J6 to J8 with their distance corrections.

These authors all conjectured regarding one or more of the theories enumerated above but few conclusions were reached.

Case report

Mr. A. G., an extremely intelligent, 58-year-old white man, exhibited the phenomenon of apparent accommodation in aphakia.

History

Between the ages of 32 and 33 years, approximately six needlings for bilateral cataracts were performed. Following the needling operations, the patient states that his visual acuity was good in each eye. An aphakic distance correction was prescribed with hook-ons to be used for reading. The patient objected to the inconvenience of using hook-ons for reading and decided to attempt to read without them. He states that at first he was able to read only relatively large print and that with difficulty. After prolonged practice, he was able to read small print with ease without the reading addition and discarded his hook-ons completely. He is unable to state just how he accomplished this, other than making a continued effort to read smaller and smaller print over a period of time. Three to four years elapsed between the time his hook-ons were prescribed and the time he discarded them completely.

The patient also gave a history of a strabismus of the right eye in youth, which was corrected surgically. Following the discission at the age of 33 years, a vertical muscle in the left eye was shortened.

Prior to coming under my care in May, 1946, visual acuity in the left eye had been poor for several years and that in the right eye had been poor for approximately two years.

Examination on entry

Visual Acuity. Vision with correction was: R.E., +12.0D. sph. ⊂ +1.0D. cyl. ax. 50° = 20/50 and J3 blurred; L.E., +10.0D. sph. ⊂ +2.0D. cyl. ax. 140° = 20/100 and J10 blurred.

Bilateral secondary membranes sufficient to reduce the visual acuity to the degree recorded were observed. Increased intraocular pressure was found in the right eye. Tension was 49 mm. Hg (McLean). All other findings were entirely negative.

The size of the patient's pupils measured: R.E., 3 by 3 mm.; L.E., 3 by 3.5 mm.

It is well to note that this man was able to read J3 with his right eye with only his distance correction in spite of a secondary membrane sufficiently dense to reduce his visual acuity to 20/50 with a pupil that measured 3 by 3 mm. in size.

Course while under my care. While under my care, the following surgical procedures were performed: Discission, left eye, May, 1946; cyclodialysis, right eye, October, 1946; discission, right eye, November, 1946.

The results of all these surgical procedures were good. The patient's visual acuity is 20/15 in each eye and the tension was normalized.

Phenomenon of apparent accommodation

The following measurements and observations were made to substantiate this apparent ability of the patient to accommodate. The distance visual acuity was: R.E., +12.0D. sph. ⊂ +1.0D. cyl. ax. 50° = 20/15; L.E., +10.0D. sph. ⊂ +2.0D. cyl. ax. 140° = 20/15. With no addition, the near-point visual acuity was: R.E., J1 at 36 cm.; L.E., J1 at 36 cm.

The patient stated that it was blacker and easier to see at 36 cm. than at 40 or 45 cm. The reading ability was equally good whether he read in the usual position or whether the reading material was held on a level with his eyes so that he was looking directly through the center of his lens. The patient's spectacles were in their normal position and definitely not allowed to slide down on his nose. At distance, this man would accept no more plus correction on his glasses although he would accept: R.E., −1.0D. sph. on the distance correction and still read 20/15; L.E., −0.75D. sph. on the distance correction and still read 20/15.

The apparent accommodative power, as measured on the cilometer, was R.E., 3.0D.; L.E., 3.25D.

An attempt was made to perform Scheiner's experiment but this was difficult because the patient's pupils could not be di-

lated with any of the usual drugs. Two openings, 0.75 mm. in diameter in size and separated by 0.75 mm., were made in a piece of cardboard. The openings were placed before the patient's distance correction in such a position that he was able to see through each opening. The ability to see through the two openings simultaneously was checked repeatedly. Under these circumstances, use of a line as a test object or a pinhole light failed to elicit diplopia, both at distance and at near. As will be apparent from experiments to be described, this was probably because multiple points at distance and near were in focus simultaneously.

Attempts to explain apparent accommodation

In light of the fact that the theories enumerated previously have suggested that almost any portion of the eyeball may, in some way, contribute to this apparent accommodative power, it was necessary to investigate the possible effect on accommodation of almost every portion of the eyeball and its adnexa. These experiments will be considered in the order of the structure investigated.

Cornea. Studies with the keratometer failed to reveal any alteration in the refractive power of the cornea as the patient was reading a chart at 20 feet or a Jaeger chart at reading distance. This experiment was performed in the following manner:

A half-silvered mirror was placed in front of the keratometer tube at an oblique angle. The observer was able to see the corneal reflex through the half silvered mirror in front of the tube at the same time that the patient read the reflection of a Snellen chart approximately 20 feet away.

Without altering the direction of the patient's gaze, a Jaeger chart was placed at reading distance from the patient's eye so that he was able to see this chart through the half-silvered mirror without changing fixation. The result of this experiment was negative—that is, there was no change in the power of the cornea, as noted on keratometer reading with the patient looking at either distance or near.

Slitlamp studies likewise failed to disclose any change in the cornea with the patient looking at distance or near.

To further eliminate any possibility of alteration of the cornea on the refractive power, a contact lens was placed on the eye. As is well known, this effectively eliminates the cornea as one of the refracting media and substitutes for it the fluid meniscus in front of the cornea. A contact lens with a 12-mm. scleral radius and 8-mm. corneal radius was used. With a +11.25D. sph. in front of this contact lens, the patient was able to see 20/15−2 at distance and J1 at 40 cm. The patient had a bit more difficulty reading J1 with the contact lens than without, and with an additional +0.75D. sph. read J1 more easily. The cilometer revealed 3.0 diopters of apparent accommodative power still remaining. The results were essentially the same with each eye.

I believe that it can be assumed that the cornea has been eliminated as the possible explanation for this apparent accommodative effort, as the result of the experiments with the keratometer, contact lens, and slitlamp enumerated above.

Anterior chamber. No change in depth of the anterior chamber was noted by slitlamp microscopy while the patient read letters at distance and at near.

Pupil. The size of the pupil has frequently been suggested as the possible basis for the apparent ability to accommodate. A small pupil would produce the effect of a pinhole, thereby accounting for this phenomenon. It is unfortunate that the size of the pupils in this case could not be influenced by the usual mydriatic or miotic drops. However, it should be noted that the effective size of the pupil was different in the two eyes of this patient and yet the apparent ability to accommodate was equal.

In the right eye, the actual size of the pupil was 3 by 3 mm. The effective size was ap-

proximately the same—that is, the pupil was clear throughout. The actual size of the left pupil was 3.0 by 3.5 mm. but its effective size was only 1.0 by 1.5 mm., since dense capsule was present in the remainder of the pupillary area.

It is also worth reiterating that this patient was able to read J3 with the right eye without an add before a discission was performed on this eye and at a time that the lens capsule was sufficiently dense to reduce the distance visual acuity to 20/50. It is also well to recall the reported case of Davis in which the patient was able to see 20/10 at distance and J1 up to eight inches from the eye without an addition and with the pupil 3.5 by 7.0 mm. in size and completely free from membrane.

The foregoing makes it unlikely that the size of the pupil is the explanation for this apparent accommodative power.

Ciliary body. Two drops of five-percent homatropine solution were instilled on two occasions at five-minute intervals in both eyes. Forty-five minutes to one hour later the accommodative power, as measured on the cilometer, was 2.75 diopters in the right eye and 3.5 diopters in the left eye.

To further eliminate the effect of the ciliary body, a retrobulbar injection of two cc. of two-percent procaine was given on the left side. Unfortunately a central scotoma developed, which reduced the distance visual acuity to 20/100—. One hour and 20 minutes after the injection, the scotoma had cleared sufficiently so that the distance visual acuity was 20/20— and at this time the patient was able to read J3. He was able to read J3 just as well at 20 inches or nine inches. The cilometer measurement revealed 2.5 diopters of apparent accommodative power. At the time of these measurements the effect of the retrobulbar injection was sufficient to paralyze the medial rectus so that it could only rotate the eyeball 2.5 mm. and the lateral rectus rotated the eyeball only 4.0 mm.

The absence of effect of homatropine and of a retrobulbar injection on the apparent accommodative power make it very unlikely that the ciliary body plays a part.

Vitreous face. It is impossible that alterations in the shape of the vitreous face could effectively influence the refractive power of the eyeball as the index of refraction of the vitreous and the aqueous are so similar. However, it is not necessary to depend upon theory; observation of the patient under consideration likewise ruled out the vitreous surface as the possible explanation. In the right eye a definite bulging forward of the vitreous face was present with a vitreous strand adherent to the posterior cornea. In the left eye the vitreous was absolutely flat and yet the apparent accommodative ability was equal in the two eyes. No change in the vitreous face was noted on examination with slitlamp microscopy while the patient read at distance and at near.

Retina. Any accurate measurement of changes in the apparent position of the retina, while the patient looks from distance to near, is almost impossible. Observations with the ophthalmoscope and with the slitlamp, using a Kleefeld mirror and Koeppe contact lens, failed to reveal any changes in the retina under these circumstances. Even if one were to theorize that the retina was pulled forward by the ciliary body, it is obvious that the situation would be made worse and consequently this mechanism could not possibly account for the facts. The effect of alteration of shape of the eyeball, and with it the position of the retina, will be considered under subsequent headings.

Muscles. As noted in the paragraph dealing with the ciliary body, a retrobulbar injection sufficient partially to paralyze the rectus muscles seemed to be without effect on the apparent accommodative power. Injections of procaine were also made along each of the four rectus muscles, extending three quarters of an inch back of the insertion, likewise without effect on apparent accommodation.

If, in spite of the above, we were to conjecture that contraction of the external ocu-

lar muscles compressed the eyeball and consequently elongated it, it would be extremely unlikely that this could occur without some change in the position of the eyeball. Measurements made from the back of the patient's spectacles to the front of the cornea failed to reveal any change in position of the cornea while reading at distance or near.

Any possible effect of lid pressure was eliminated by simply holding the lids away from the eyeball, with no effect whatsoever on the patient's reading ability.

Effect of magnification of the strong convex aphakic correction

It was previously mentioned that a convex lens of 13.0-diopters' power produced a magnification of approximately one and one-third times so that a patient only able to read J2 with some difficulty would be able to read J1, due to this magnification. Influence of this magnification was largely eliminated by using a contact lens in the following manner:

A contact lens, with a 6.5-mm. corneal radius, was placed on each eye. With a contact lens of this radius, the patient only needed an additional 3.0D. correction in the right eye to see 20/15 at distance and only an additional 1.0D. correction in the left eye to see 20/15 at distance. The patient was still able to read J1 from 28 to over 70 cm. without an addition. Measurements with the cilometer disclosed 3.25 diopters of apparent accommodation in each eye.

Tests proving no real accommodation was present

The following tests prove that the patient did not actually accommodate—that is, he did not change the total refractive power of the eyeball:

Experiment I (Retinoscopy). Retinoscopy while the patient was reading at 20 feet and at 13 inches failed to reveal a change in the total refractive power of the eye.

Experiment II (Haploscopic measurements). Measurements on a standard haploscopic device revealed only 0.75 diopter of accommodative power in each eye. This is an average finding for any nonaccommodating eye.

In using the haploscope the patient fixes on a letter at 20 feet and at the same time observes a red dot which is superimposed upon the letter through a half-silvered mirror. The patient focuses the red dot by adjusting a screw at the same time that the 20-foot letter is focused. The patient then reads letters at 13 inches and refocuses the red dot. The differences in the measurement indicate the accommodative power.

Experiment III (Use of a screen grid). The patient focused on a letter 20 feet away while looking through a window screen held a few inches from his eye. Both the letter at 20 feet and the wires composing the screen were perfectly clear simultaneously. This demonstrated that points 20 feet away and a few inches away were in focus at the same time and therefore the patient did not actually change focus while looking from distance to near, or the reverse. A normal accommodating eye sees the letter at 20 feet clearly and the screen definitely blurred while looking at the far point, or the screen clearly and the distant letter blurred while looking at the near point, but the two are never clear simultaneously. A presbyopic eye simply does not see the screen clearly.

The patient under consideration was able to see the far point (letters) and the near point (screen) clearly at the same time whether the screen was held a few inches from his eye or at any point up to arm's length. This demonstrated that all of these points were conjugate with the retina simultaneously and that the patient did not actually accommodate.

Experiment IV (Modification of Experiment III). The patient looked at a mirror 13 inches from his eye and saw a letter 20 feet away on an illuminated chart. The remainder of the room was dark. A tiny letter was pasted on the mirror directly in the line of vision of the letter 20 feet away. The tiny letter was only visible as a dot in the dark-

ened room. A light was then flashed on the mirror and the dot immediately became clearly visible as a letter. This again demonstrated that the patient did not have to take the necessary time to focus his eye. A normal accommodating eye took an appreciable length of time to discern the small letter pasted on the mirror after the light was flashed on. Therefore, it is obvious that this patient did not have to change focus from the far point to the near point.

Other aphakic patients with apparent accommodative power

Several other patients have been observed who possess some degree of apparent accommodative power but who would not submit to a complete study.

E. G., a 49-year-old, bilaterally aphakic, white woman showed: R.E., with a +12.0D. sph. ⊖ + 1.0D. cyl. ax. 150° =20/15 and J4 at 15 inches; L.E., with a +12.5D. sph. = 20/15 and J5 at 15 inches. The pupils were 4.0 mm. in diameter, reacted well to light, and were clear throughout. The patient did not respond to requests to return for further work-up.

L. G., a 24-year-old, bilaterally aphakic, white woman, had cataracts removed by linear extraction at the age of 13 years. Vision with correction was: R.E., +5.0D. sph. ⊖ +3.0D. cyl. ax. 165° = 20/25 and J4 at 14 inches, straight ahead; L.E., +8.0D sph. ⊖ +1.5D. cyl. ax. 30° = 20/20− and J4, straight ahead. External inspection of the right eye revealed a small capsular opening within the pupillary area; whereas, the left pupil was almost entirely clear throughout. Further studies could not be completed on this patient.

E. B., a 28-year-old, bilaterally aphakic, white woman, showed: R.E., +12.0D. sph. ⊖ +0.5D. cyl. ax. 180° = 20/25, distance, and J5 at 30 cm. without add.; L.E., +12.0D. sph. ⊖ +1.0D. cyl. ax. 135° = 20/25, distance, and J4, without addition.

V. W., a 31-year-old, bilaterally aphakic, white woman, had corrected vision of: R.E., +12.5D. sph. = 20/25+, distance, and J5 at 25 cm., without add.; L.E., +12.0D. sph. ⊖ +2.0D. cyl. ax. 120° = 20/20 and J1 at 25 cm. without addition.

It is to be noted that a pinhole opening was present in the capsule in this patient's left eye.

H. L., a 27-year-old, white woman, bilaterally aphakic, showed: R.E., +16.0D. sph. = 20/15, distance, and J4 at 30 cm. without add.; L.E., +16.0D. sph. ⊖ +2.0D. cyl. ax. 110° = 20/15, distance, and J8 at 30 cm. without addition. This left eye was amblyopic.

It will be noted that all of the patients presented are young aphakics. With the exception of the patient presented in detail, Mr. A. G., all of the others developed cataracts following dinitrophenol therapy. This accounts for their youth and the female sex. All of the patients presented briefly had their pupils dilated with cocaine without effect on their reading ability. All of them revealed a range in which they were able to read the Jaeger card varying from a minimum of 21 to 31 cm. from the eye to a maximum of 15 to 70 cm. from the eye.

Discussion

Aphakic patients who are able to read J1 with only the distance correction do not actually accommodate. I believe that this has been definitely proven in the four experiments outlined above, as well as by the elimination of the effect of all structures in the eye and the adnexa which could aid in the accommodative effort.

Certain other "optical tricks," such as sliding the glasses down on the nose and looking through the periphery of the lenses, have also been eliminated.

There remain a number of possibilities which may explain in part or entirely how this phenomenon takes place. The most important of these is the caustic formed by the spherical aberration of the cornea. In the normal eye much of the spherical aberration of the cornea is neutralized by the lens.

When the lens is removed, the spherical aberration of the cornea is a greater factor. Although spherical aberration is a factor in all aphakic eyes, the resulting caustic is probably longer and narrower in some eyes than in others. Even though the spherical aberration of the cornea is removed by a contact lens, it is replaced by a spherical aberration of the contact lens which is of the same magnitude.

The pinhole effect of a small pupil is certainly a factor in some cases, although it is not in others. It should be noted that the pinhole effect of a small pupil neutralizes the spherical aberration of the cornea. When the pupil is small, the spherical aberration caused by the cornea is largely eliminated, but a patient may be able to see at distance and near because of the pinhole effect. When the pupil is large, the spherical aberration may produce a long caustic so that the patient is able to see at both distance and near.

The capacity of some eyes to see better than 20/15 cannot be denied. A patient may, therefore, be overcorrected three quarters to one diopter at distance and yet read 20/15, and with the same correction be undercorrected only one diopter at 50 cm. and read J1. Although this is not in itself able to account completely for the phenomenon observed, it may be an important factor. Magnification of the aphakic correction produces precisely the same effect.

The phenomenon of apparent accommodation may be explained by a combination of pinhole effect, spherical aberration, unusually good visual acuity, and magnification of the correction. For example, if one aphakic patient in 20 had one or more of the foregoing factors, then one patient in a thousand may have the proper combination to produce this phenomenon.

Conclusion

Patients exhibiting the phenomenon of apparent accommodation in aphakia have been observed and reported at frequent intervals. They do not actually accommodate. The phenomenon may best be explained by a combination of one or more of the following: Optical aberration, magnification of the correction, exceptional visual acuity, small aperture, tolerance to blur, or slight overcorrection for distance.

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SUBCONJUNCTIVAL DRAINAGE OF THE ANTERIOR CHAMBER BY A GLASS SETON*

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Everyone who knows the danger and destructiveness of glaucoma and the relative inadequacy of its treatment will understand the continuous efforts that are being made to improve the understanding and means of treatment of this condition.

With our limited knowledge of the fundamental cause of glaucoma a rational etiologic treatment is not as yet possible. For the time being we have to be satisfied with the results we get from symptomatic treatment, either conservative or operative. Frequently we succeed in controlling the increased intraocular pressure but there are still too many cases where it will rise again and necessitate repeated operations, each causing more damage to the already diseased eye. In rare instances, despite the pressure being well under control, the disease may progress and cause its destructive effect because this supposedly normal tension is too high for the particular eye. In general, however, a control of the tension is the best that we can hope to obtain by the various therapeutic measures available to us.

The conception of seton operations for glaucoma is not new. It is surgically sound to insert a drain into the incision so as to prevent it from closing and thus cause the operation to fail. If we may judge from the sporadic reports in the literature, this aim has been achieved. The pressure was usually well controlled even in cases in which other operations had failed; however, the various methods employed have apparently never become popular.

The thought of intentionally introducing a perforating foreign body into such a delicate organ as the eye has certainly caused a feeling of uneasiness both to patient and surgeon alike so that this operation has been tried only rarely and, with a few exceptions, only in cases with absolute glaucoma.

It is not the aim of this paper to evaluate the seton operations in comparison with other antiglaucomatous operations. The seton operations have been employed far too rarely to allow any evaluation of their results. In this paper we merely wish to give a preliminary report of our experiments with glass rods of a special shape which were introduced into rabbit eyes.

The purpose of this work was to find an easy and useful operative procedure for the drainage of the intraocular fluid, and to study how such a foreign body is tolerated by the ocular tissues.

Reports of clinical observations on this subject in the literature almost all record a good tolerance of the various implants employed. These reports appear surprising in view of the fact that even threads of silk (Mayou, 1912-13, Zorab, 1912-13; Wolfe and Blaess, 1936) which often cause inflammatory reactions and granulomatous formation have been used. Furthermore, horse hair (Row, 1934) being an organic substance, cannot be quite inactive over a long period of time (Lang, 1908). Gold drains (Weekers, 1922) and gold wires (Stephanson, 1925) are well tolerated. Strips of magnesium inserted into a cyclodialysis wound (Troncoso, 1940) did not cause any unusual reactions. Drainage with epithelial tissue was tried with good tolerance (conjunctiva: Gradle, 1927; lacrimal-canaliculus transplants: Gibson, 1944).

Almost all of these drains were inserted so as to drain from the chamber angle into the subconjunctival space. However in the case of Weekers' operation, the vitreous space is drained subconjunctivally, and

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Troncoso's operation establishes a communication of the chamber angle with the perichoroidal space.

It occurred to us that glass rods of Jena or Pyrex glass might be well tolerated and most suitable as a drain. This glass is practically insoluble and therefore inert and its

Fig. 1 (Bock). Showing the filtration canal lined by endothelium

pH is very near to that of the body tissues. It is, moreover, quite resistant against mechanical influences. Clinical experience and pathologic examinations have shown that, of all substances introduced during perforating injuries of the eye, glass is the best tolerated. Our findings on five rabbit eyes which had the rods implanted for 3 to 5 months substantiate these observations.

After the introduction of the glass rod into the eye, there was clinically only a slight injection which disappeared within 5 to 8 days leaving the eye perfectly clear for the rest of the time. In some instances a large filtration bleb persisted for 10 days or more. Among the 14 operations performed (it is to be noted that at least two operations were performed on each of the six rabbit eyes) we observed only once a deep infiltration of the cornea near the site of the incision which, however, cleared up in two weeks' time.

The lens has remained clear by slitlamp examination throughout the experiment. A slight pressure atrophy of the iris in the periphery at the place where the rod rested was observed by slitlamp in some instances. Five of the six rabbit eyes were examined histologically. In one of them the glass rod had been taken out 10 days before the animal was killed so as to see whether the canal would remain patent even without the drain. In the other four eyes the glass rods were removed after the eyes were enucleated for the examination. Serial sections of the region of the implant were made in all five cases.

Figure 1 represents the typical picture as it was found in two eyes; Figure 2 that of the other two eyes. The absence of inflammatory changes and the tectonic adjustment of the connective-tissue fibers to the implant is common to both. What differentiates them

Fig. 2 (Bock). Filtration canal and cavity without endothelium.

is that the cavity in Figure 1 is lined by a thickened endothelium which is absent in Figure 2. The two eyes which showed this endothelial lining belonged to two different

animals. They had been particularly subjected to massage (moving the rod back and forth with a blunt forceps) and this might have stimulated the ingrowth of the endothelium. In the fifth eye where the glass rod had been removed 10 days before the death still invariably slip either into the anterior chamber or towards the subconjunctival space. After several failures we finally succeeded by using glass rods 3 to 4 mm. long, and 0.75 mm. thick, with the two ends enlarged and flattened (fig. 3 and 4). The en-

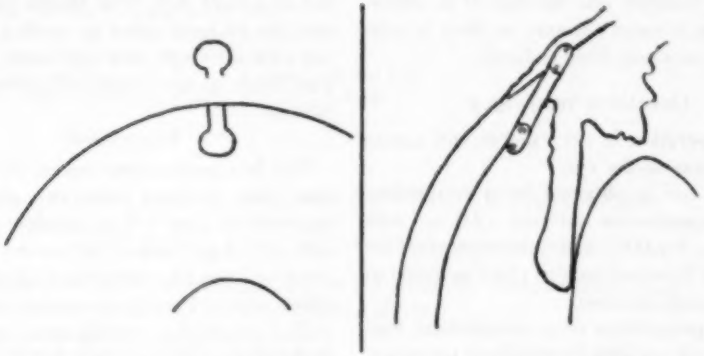

Fig. 3 (Bock). Showing the shape of the glass rod and its position in the eye in a frontal and lateral view.

of the animal no endothelium was found, but instead a plug of dense connective tissue filled the incision which was clearly marked by the cut in Descemet's membrane.

Theoretically, a filtration canal lined by endothelium has much more chance to remain patent than one with a fibrous wall. On the other hand, a good and lasting filtration is often produced by the various fistulating operations (Elliot, iridencleisis, and so forth) where there is no endothelial ingrowth into the canal. Further experiments, particularly on glaucomatous eyes, will have to clear this point of the importance of endothelial ingrowth for the filtration of the scar. In our rabbits the intraocular pressure was the same before and after the operation and with and without endothelial lining of the canal so that no conclusion can be drawn.

The main problem in the operation was the fixation of the glass rod. Even if the scleral incision was made very small, just large enough to let the rod pass, it would

largement keeps the rod in place and the flattening makes introduction easier and diminishes friction on the bulbar conjunctiva by the movement of the lids.

Instead of solid glass rods, capillary tubes of about the same shape were also tried.

Fig. 4 (Bock). Showing the glass rod in position in the rabbit eye.

They are much more difficult to make. Their effect on the pressure was too marked and it is thought that they produce an undesirable hypotony. For this reason they were not tried in patients. The danger of breakage of the glass rods is extremely slight; once they are inserted into the eye, it is almost impossible to exert pressure on them in such a way as to cause them to break.

Operative technique

The operation is very simple and causes little trauma to the eye.

Anesthesia is obtained by a retrobulbar novocain-panthesine mixture (2.0 cc. with adrenalin, 1:1,000) and subconjunctival injection of 0.2 cc. of cocaine (four percent) at the 12-o'clock position.

After preparation of a conjunctival flap, such as for an Elliot trephining operation, incision of the sclerotic begins 1.0 to 1.5 mm. from the limbus in the direction of the anterior chamber angle. A small, narrow keratome or the ab externo route is used.

Great care has to be taken to make the opening as small as possible—just big enough to allow the rounded end of the glass rod to pass—and to lose as little aqueous as possible, because the introduction of the rod may become difficult if the chamber is too shallow or absent. In a large incision, moreover, there is the danger that the rod will not remain in place. The introduction of a narrow spatula will tell us the position and size of the opening.

Then the glass rod is taken by its flat, rounded end with a curved conjunctival forceps, or, even better, with a forceps armed at its tips with thin rubber plates. The glass rod is inserted into the incision until the rounded end just appears in the anterior chamber. The conjunctival flap is then closed by a continuous suture. An argyrol (25 percent) dressing is then used.

The after treatment is very important. During the first week, the surgeon should gently massage the eyeball twice a day beginning the day after the operation. Later on the patient himself may continue this for some more weeks. This will prevent the formation of a too tight scar tissue around the rod, and the chances of a good drainage are greatly increased by this simple procedure. If the pressure should show a tendency to rise at a later date, it is always possible to start the drainage again by moving the glass rod with a forceps back and forth and sidewise after a few drops of pantocain anesthesia.

Discussion

This is a preliminary report. We have, to date, only operated upon two patients by this method. One had an absolute glaucoma with very high tension and severe pain; the other, a chronic congestive glaucoma in which repeated antiglaucomatous operations (Elliot trephining, cyclodialysis, and cyclodiathermocoagulation) had failed to control the pressure, and the eye had become almost blind.

In both cases the effect on the pressure has been very good; however, the time of observation is too short as yet to allow any conclusions to be made. Encouraged by the good result we shall continue to use this operation in cases in which it seems indicated, and we shall report on the results obtained at a later date.

Summary

A new type of seton operation for glaucoma is described as it was worked out on rabbit eyes and tried with good results in two patients with advanced glaucoma. A glass rod of a special shape, made of Pyrex, was used and employed as described in the text.

At the present time experiments are being performed with other materials so as to determine their tolerance in the eye and the possibility of employing them in place of the glass rods.

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I wish to express my sincerest thanks to Dr. J. Babel, chief of the laboratory, for his help and suggestions during the experimental work.

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THE CLINICAL STATUS OF THE CONTACT LENS

RESULTS OF A STUDY BY THE QUESTIONNAIRE METHOD

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According to Case[1] (1946) widespread and satisfactory use of contact lenses was a reality. Actually, the literature has been concerned chiefly with the technical aspects of the problem. Clinical results have been given little attention. A fairly complete review of the subject by Gross[2] (1947) suggests that the problem of tolerance is not solved.

There have been several statements suggesting that the use of contact lenses is not generally as satisfactory as the previous literature and widespread publicity would seem to indicate. Nugent[3] (1948) states "Contact lenses, to date, have not proved satisfactory in the majority of instances. . . ."

Ida Mann[4] (1947) in a survey of 100 of her patients suggested need for further attention to solutions which, in the main, were blamed for the dissatisfaction she found.

Albaugh[5] (1947) points out that "a contact lens must be considered to be a foreign body which is potentially dangerous to the eye." He called attention to the recognition of such dangers by the insurance companies, some of which had made new rules covering those prescribing contact lenses. According to Albaugh, the average successful wearer used lenses for three and one-half hours before changing the fluid.

SCOPE OF STUDY

It was felt that a survey on a nationwide basis, which would reflect the opinion of interested persons, would be of value in determining the true situation. During the process of collecting data it was learned that Berens[6] was gathering similar information. The results of his survey for the American Committee on Optics and Visual Physiology appeared in June, 1949. These findings will be referred to later.

Questionnaire I was sent to a large group of doctors and the replies were consolidated and analyzed. Questionnaire II of a different nature was sent to patients (through the cooperating doctors).

Questionnaires I and II were sent to 300 diplomates of the American Board of Ophthalmology in a manner calculated to give a sampling of all sections of the country.

Sixty-two ophthalmologists replied. In addition 107 completed forms from patients were received. Three of the 62 doctors replying were conducting independent studies and submitted no opinions or data.

In this report are included the answers to the questionnaires as given by the 59 doctors and the 1,407 patients for whom contact glasses were prescribed. Their reactions were

given directly in the 107 individual replies or in the summaries sent in by the doctors.

Manufacturers and dispensers were not included because it was felt that their viewpoint might possibly be biased and their contact with the dissatisfied patient less enduring.

Tabulation of replies from physicians

Question 1. How many pairs of contact glasses have you prescribed?

1,407 (total).

Question 2. Is your work in this field increasing or decreasing?

2 Increasing.
12 Unchanged.
25 Decreasing.
13 Not answering.
7 Do not fit contact glasses now.

Question 3. Are you satisfied that the time and effort is justified?

9 Yes.
24 No.
12 In special cases.
9 Not answered.

Question 4. Method used?

0 Tangent.
2 Stock.
38 Mold.
19 Not answered.

Question 5. Complications?

5 Yes.
49 No.
5 Not answered.

An analysis of the replies to the physicians' questionnaire (1) reveals, in answer to Question 1, that the total of 54 doctors answering this question had prescribed approximately 1,407 pairs of contact glasses in the past five years (a few physicians included some cases seen during the past 10 years).

The majority of doctors answered Question 2 with one word, "decreasing." Only two felt that their contact-glass work was increasing; 12 felt there was no change; seven had given up prescribing contact glasses.

Comments varied. One eastern ophthalmologist commented, "I did a great deal of work with contact glasses 15 years ago. Now I do as little as possible, usually referring the patient to another ophthalmologist." A southern ophthalmologist stated that the reason for an increase in the use of contact glasses in his city was that numerous technicians had become available after the war. A middle-westerner stated, "My work in this field is decreasing because I make a definite attempt to discourage patients seeking contact lenses for mere myopia." Another eastern ophthalmologist was of the opinion that, "The young girl with myopia who demands contact lenses to enhance her appearance should be spanked and put to bed." Many would seem to concur.

The answer to Question 3, was generally in the negative. Twelve doctors felt that while contact glasses were usually unsatisfactory in unselected cases, they would continue to use them in special cases or in the presence of such a pathologic condition as keratoconus.

One middle-western ophthalmologist presented an excellent summary of his considerable experience with contact glasses and commented, "I might say here that we accept no true cosmetic cases and are very particular in our screening as we feel that contact glasses are useless unless the patient gets considerable improvement in vision, comfort, or visual efficiency."

Another typical comment from a well-known ophthalmologist who heads a university department: "In the past 8 or 9 years, patients for whom I prescribed contact glasses have had so much trouble with them that I have ceased to prescribe them except when strongly indicated, i.e., keratoconus."

An easterner remarked, "I am quite satisfied that contact glasses justify the time and effort. I shall qualify that by stating that it takes very little of my time. The greater part of the work . . . is done by a technician. I just refract the patient with and without the lenses. . . ."

Another eastern ophthalmologist was of the opinion that "50 percent of the patients do not bother to wear contact lenses after the first six months when the novelty has worn off."

All but two physicians had been fitting contact lenses by the mold technique, since the majority felt that the mold technique was by far the most accurate and satisfactory. The majority reported that there were no complications, except for irritation and redness, just before or after removing the lenses, because of intolerance.

A few mentioned occasional corneal erosions of the cornea, desquamation, corneal ulcer, and one case of superficial punctate keratitis. The physicians did not consider corneal edema or conjunctival injection as complications. Berens[4] mentions more severe complications such as corneal ulcer with extensive scarring, in one case with loss of an eye.

Comment

In a case of old healed keratitis seen by one of us,[7] an attempt was made to fit contact lenses by the mold method. The superficial keratitis became activated. Over an eight-month period one eye showed desquamation, filamentous keratitis, and punctate keratitis at different times. At no time was the eye quiescent. The patient was seen by many doctors, privately and in clinics.

She had surgical procedures, such as corneal scraping, iodine application to the cornea, sinus surgery, and removal of tonsillar tags —all without help.

Another case, reported to the eye society,[8] was a case of operative aphakia in which the fitting of a contact lens led to rupture of a healed cataract incision many months after the surgery.

A doctor[9] reported the apparent marked decrease in accommodation on the use of contact lenses. This finding is more frequent than is usually noted.

Results of questionnaires to patients

A total of 107 patients replied directly to Questionnaire II. In addition to information received from this source, many ophthalmologists replied for their patients using as their source of information the results obtained by either verbal or written inquiry or by an analysis of their own records. The total number of patients directly or indirectly investigated is 1,407.

However, since the replies from the ophthalmologists did not entirely answer the patient questionnaire in a manner from which statistics could be compiled, we have preferred to use only the 107 patient questionnaires completed exclusively by the patients themselves. Table 1 is a tabulation of the patient responses.

Study of Table 1 shows that the young adults in the 20 to 30 year age group constitute by far the largest group of contact-glass wearers. The majority (68 to 39) were women and more than half of these were unmarried.

A wide variety of occupations was represented (table 2). It is noteworthy, however, that 29.19 percent of the patients who answered the questionnaires were students. The only other large group was the housewife group representing 19.6 percent of the total.

Fifteen patients felt that contact glasses were necessary for their occupations. These included a geologist, registered nurse, mechanic, model, motor patrolman, abstractor of titles, musician (appearance also), music student (appearance also), school teacher, and six college students who wore the contact glasses for sports but considered this an occupational need. In addition, 13 students wore contact glasses for sports only but did not feel that this was an occupational need.

The majority of the patients in this series have not worn contact glasses for a great length of time. Only 14.5 percent had worn contact glasses for over three years. This fact would tend to conflict with the medical impression of a decrease in the number of contact glasses prescribed except that we note that the 1 to 2 year group and the 2 to 3 year group combined make up 67.2 percent of the total, and only 16 or 14.9 percent had acquired contact glasses during the past year. This presents an interesting fact for analysis and would seem to bear out the doctors' impression. As will be seen later, a majority of persons felt that contact glass prices were not unreasonable and so this apparent decrease in the acquisition of contact glasses is probably not due to economic factors.

Every patient in this series had a mold made of his eyes during the process of getting contact glasses. Since the doctors generally agreed that this is the most accurate method, it is proper to state that the patients in this series received the benefit of the best procedures now used.

Sixty-six patients (61.6 percent) stated that they had obtained contact glasses for appearances only, while 28 (26.2 percent) felt that they obtained vision not possible with ordinary glasses, and seven (6.5 percent) needed contact glasses for pathologic conditions (aphakia, two; keratoconus, five). Obviously, for the laity, contact glasses are primarily cosmetic devices. Doctors, however, prefer not to order contact glasses for cosmetic reasons only.

Only 33 (30.8 percent) of the patients in this series wore their contact glasses for some time each day. An equal number had given up contact glasses entirely and the remaining 41 patients (38.3 percent) wore them only occasionally. These facts, in addition to the fact indicated in Table 1 that the majority of patients could wear the glasses for less than five hours, are disheartening. Discomfort and cloudiness of vision determined this short period of use in 71 percent of the cases (26 patients, however, did not answer this question, and five took the glasses off after the special need, such as sportswear, was no longer present).

Seventy-eight patients (72.8 percent) stated that they had trouble with their contact glasses. Of these the majority (46.7 percent) blamed the solutions and only a few (15.8 percent) felt that the glasses did not fit properly. A variety of other causes of dissatisfaction was given, including irritations of the eyes (23.3 percent) and trouble inserting or removing the glasses (18.6 percent). In spite of these troubles, 55 patients (51.4 percent) stated that they were satisfied with their contact glasses; whereas 40 patients (37.3 percent) were not satisfied.

Of the patients who expressed satisfaction with contact glasses, 10 qualified their answers by stating that they wished that they could tolerate them for longer periods, or that they could get better solutions, or that they were satisfied with the glasses for special purposes (sports, and so forth).

Table 3 shows a statistical breakdown into the age group and length of time of possession of contact glasses, comparing those who are satisfied with contact glasses and those who expressed dissatisfaction. From this table, it is apparent that the age of the patient and the length of time of possession of contact glasses were not factors in the satisfaction of the patient.

TABLE 1

SUMMARY OF FINDINGS BASED ON QUESTIONNAIRES RETURNED BY PATIENTS

Questionnaires Returned: 107

Age Group (years)		*Sex*		*Marital Status*	
10–20	17	Male	39	Single	61
20–30	52	Female	68	Married	41
30–40	22			Widowed	4
Over 40	16			Divorced	1

1. *How long have you had contact glasses?*

Less than 1 year	16	Over 3 years	16
1–2 years	44	Could not wear	3
2–3 years	28		

2. *Was a mold made of your eyes when you were fitted for contact glasses?*

Yes	107
No	0

3. *Were your contact glasses necessary for:*

a. Occupation	15	c. Treatment of an eye condition	7
b. Vision	28	d. Appearance	66

4. *How often do you wear your contact glasses?*

None	33	Several times weekly	11
Daily	33	Occasionally	30

5. *Do you alternate contact glasses with ordinary glasses?*

No answer	10
Yes	69
No	28

6. *How many hours can you wear your contact glasses at any one period of time?*

Less than 1 hour	2	More than 5 hours	24*
1–3 hours	26	No answer	10
3–5 hours	42	None	3

What determines the length of this period?

Discomfort	33	Cloudiness	43
Nonocular factors	5	No answer	26

7. *Do you have trouble with your contact glasses?*

Yes	78
No	27
No answer	2

8.† *If yes, do you think the trouble is due to:*

a. the solutions	50	d. trouble inserting or removing glasses	20
b. fit of the glasses	17	e. vision	9
c. irritation of eyes	25	f. other	4

9. *Are you satisfied with your contact glasses?*

Yes	55
No	40
Uncertain	8
No answer	4

10. *Has it been necessary to change the prescription of your contact glasses since you obtained them?*

Yes	12
No	89
No answer	6

How often?

1 time	9
2 times	1
3 times	1
6 times	1

11. *Have you felt that the price of the contact glasses was reasonable?*

Yes	66
No	29
No answer	12

TABLE 1—*continued*

12. *Will you continue to wear contact glasses?*	
Yes	79
No	21
No answer	7

* Of these, five specifically stated that the periods were broken up by alternation or change of fluid at end of 3 or 4 hours.

† Some gave more than one answer to this question.

TABLE 2

OCCUPATION CHART

Student	32	Clerk	5	Artist	1
Housewife	21	Technician	7	Model	1
Salesman	2	Musician	1	Librarian	1
Secretary	8	Physician	1	Businessman	1
Teacher	7	Nurse	3	None	4
Bookkeeper	3	Patrolman	1	Social Worker	1
Radio announcer	1	Laborer	5	Geologist	1

TABLE 3

SUMMARY OF SATISFIED AND DISSATISFIED CONTACT-LENS WEARERS

Satisfied		*Dissatisfied*	
Age Group		Age Group	
10–20	15.5%	10–20	17.2%
20–30	48.2%	20–30	45.6%
30–40	24.1%	30–40	17.2%
Over 40	12.0%	Over 40	19.5%
Length of time of contact glasses		Length of time of contact glasses	
Less than 1 year	25.8%	Less than 1 year	13.9%
1–2 years	30.5%	1–2 years	41.8%
2–3 years	29.3%	2–3 years	25.5%
Over 3 years	13.7%	Over 3 years	18.5%
No time given	0.7%	No time given	0.3%

COMMENTS AND CONCLUSIONS

Dividing the patients into two groups based on "need" for the contact lenses, we found that in the "cosmetic" group the patients were able to wear the lenses without change for an average of 2.9 hours. The average number of years during which contact lenses had been worn was 1.6 years. Of the 66 cases in this group, 26 no longer wore the lenses.

In the second group, consisting of those using the lenses for pathologic conditions such as keratoconus, or for occupation or sports, the average wearing time was 3.4 hours without a change. The average number of years worn was 2.8 years. Of this group of 41 cases, there were eight patients who no longer wore the contact lenses.

The greater the need the more likely is the patient to tolerate the contact lenses but, even in cases in which the need is great, the wearing time is still too low in most cases.

According to Berens' report,[6] "The main problem at the present time, provided that the fitting is correct, is that of hazy or cloudy vision. Blurring of vision occurs inevitably after wearing a contact lens for some hours because of the altered metabolism of the cornea."

In general, Berens' report, insofar as it

goes, agrees with the results of the survey here presented. It is suggested that the altered metabolism is due largely to the pressure on the area surrounding the limbus. This results in edema of the conjunctiva and interference with the circulation in and around the limbus. Definite changes can be observed in the conjunctiva and cornea by slitlamp examination (Gross,[2] Treissman and Plaice,[10] Sattler,[11] Fairbough,[12] Ridley[13]).

The fluid so frequently blamed for the trouble seems to be a minor factor. Actually the fluid exchange present, as demonstrated by the ease with which fluorescein enters the chamber formed beneath the contact lens, indicates that the initial fluid is replaced (all or in part) by the fluids usually bathing the cornea.

Recently Nugent[3] described the Touhy corneal lens, which has acquired many enthusiastic supporters in the short time it has been manufactured. This lens used without special fluids and without a scleral portion has many promising advantages, especially those of long tolerance and elimination of the troublesome use of special fluids. It has, however, certain disadvantages, not yet completely eliminated. Some of those are (1) the mobility of the lens—sometimes disconcerting; (2) the difficulty in applying the lens to very high ametropia and to keratoconus; (3) the rather frequent presence of superficial keratitis even in cases without complaint (probably due to mobility of lens, drying spots of cornea, abrasive substances in tears and secretions, and so forth).

This superficial keratitis, although it usually disappears rapidly in a few hours, is a potential source of danger to the patient, especially in cases of pathologic conditions of the cornea. From a medicolegal aspect it may be troublesome to the physician.

Until the problems connected with contact lenses are well appreciated and cared for, ophthalmologists would do well to discourage dispensers and manufacturers from overenthusiastic exploitation.

It would seem that contact lenses, including the corneal lenses, require further research and close observation by the prescribing doctor before widespread acceptance by the public is encouraged.

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LEIOMYOMA OF THE CILIARY BODY*

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Leiomyomas of the uveal tract are extremely rare tumors. There is not much clinical significance to these neoplasms, as they do not represent a considerable percentage of all the uveal tumors. They are, however, of great pathologic interest and have caused a considerable amount of speculation as to their genesis, histologic differentiation, and clinical picture.

The difficulties in differentiating a leiomyoma of the uveal tract from a spindle-cell sarcoma are well known and have been emphasized by many authors. Verhoeff set down the histologic requirements which a leiomyoma of the uveal tract should fulfill in order to be classified as such a tumor. No case of uveal leiomyoma can properly be evaluated unless the adequate stainings have been done.

Leiomyomas of the iris have been reported more frequently since Verhoeff published his case. Moulton and Moulton have recently summarized all these cases and added one case of their own. They do not include the questionable case of Heuven and the more recent case of Fleming. The leiomyoma of the iris is therefore a tumor, the histologic features of which have been described fairly often. Even the clinical appearance and the symptoms of a leiomyoma of the iris seem to present a more or less clear-cut picture.

Reports on leiomyoma of the ciliary body on the other hand are rare. There is no case on record where the nature of such a tumor was proven by special staining. No smooth-muscle tumor of the ciliary body has yet been reported in this country.

The ciliary body with its abundance of smooth-muscle tissue should theoretically be a site of predilection for the occurrence of a leiomyoma but, on the contrary, such tumors seem to occur extremely rarely in this part of the uvea. They seem to be rarer in the ciliary body than in the iris. Smooth-muscle tumors of the iris may stem from the dilator or sphincter muscle of the pupil, in which case they are epiblastic; or they may stem from smooth muscle fibers of the vessels, in which case they are mesoblastic. Leiomyomas of the ciliary body are mesoblastic in any case, whether they derive from the ciliary muscle itself or from the smooth-muscle fibers of the wall of a ciliary vessel.

SURVEY OF LITERATURE

Mitvalsky collected the old reports on cases which were believed to be leiomyomas of the ciliary body. He found six reports, but did not accept any of them as a smooth-muscle tumor. It is impossible to agree or disagree with him, as no special stainings had been performed in these cases. In adding a case of his own Mitvalsky regards all these tumors as fascicular spindle-cell sarcoma and doubts very much the occurrence of leiomyomas in the ciliary body.

Axenfeld anticipated the occurrence of smooth-muscle tumors of the ciliary body. Fuchs in his extensive studies on the histology of the ciliary muscle described a beginning myoma of this muscle found, incidentally, in an enucleated globe.

Since Fuchs reported this case in 1928, three cases have been reported as leiomyoma of the ciliary body in the literature. Velhagen made the histologic diagnosis in his case on the basis of the morphologic features and the reaction of the tissue to the van Gieson staining. Bossalino's case was a comparatively benign new growth with the typical appearance of a smooth-muscle tumor. Portions of the tumor reported by Pieck were

* From the Department of Pathology of the Institute of Ophthalmology, Presbyterian Hospital, New York. This paper is dedicated to the 75th birthday of Dr. J. Meller, professor emeritus of ophthalmology, University of Vienna.

shown by the van Gieson stain to contain smooth-muscle tissue. All three cases might very well have presented instances of leiomyoma of the ciliary body; they cannot be accepted without some reservations as their nature was not conclusively proven.

Report of a case

A case is reported in which the diagnosis of a smooth-muscle tumor seems to be justifiable.

History. The 40-year-old woman, M. M. (unit number 712,583, patient of Dr. H. D. Brown), complained about pain and impaired vision in her right eye which she had noticed for about six months. Before that time she had had no trouble with her eyes.

Eye examination. On admission the right eye was perfectly normal and the vision was 20/15 with correction.

The anterior segment of the left eye was normal. There was a serous retinal detachment on the temporal side. A black mass could be seen in the periphery of the fundus at the 3-o'clock position, apparently lying in the ciliary body. This tumor interfered with transillumination. The tension in the eye was normal. The vision was hand movements only.

The probable diagnosis was sarcoma of the left ciliary body and the eye was enucleated. The postoperative course was uneventful.

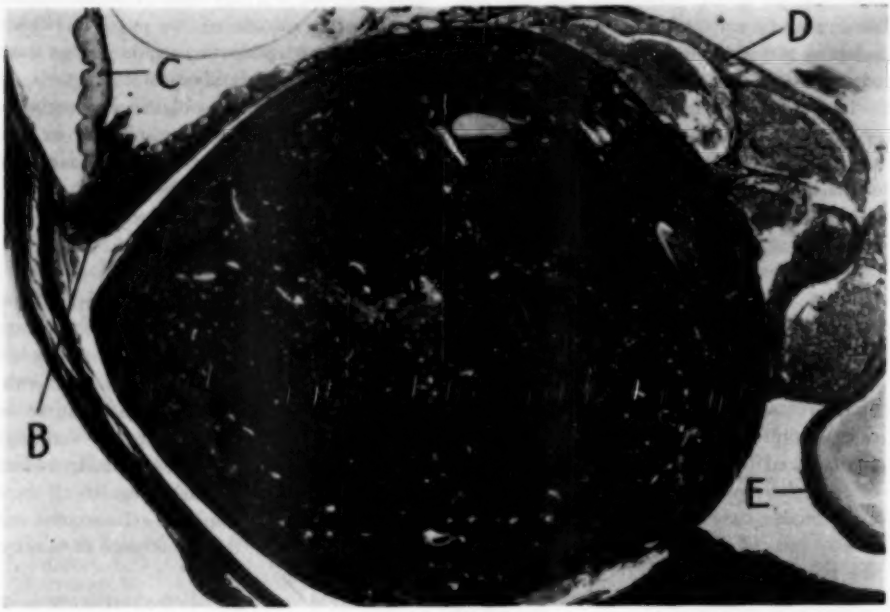

Fig. 1 (Blodi). Leiomyoma of the ciliary body. The tumor (A) replaces the larger part of the ciliary body. The anterior part of the latter (B) and the iris (C) are normal. There is extensive proliferation of the ciliary epithelium (D) and detachment of the retina (E).

At the opening of the eyeball a large tumor was noted in the temporal part of the ciliary body.

The histologic examination of the eye (pathology number 2,746) shows a large round tumor in the region of the ciliary body and the anterior part of the choroid (fig. 1). The tumor replaces the larger part of the ciliary muscle and only the most

anterior part of the latter remains unchanged. The tumor has sharply defined edges and does not show any infiltrative growth. It rests on the sclera, which is a little thinner in that region and somewhat ectatic. The pigment epithelium covers the tumor nearly completely without undergoing severe changes. Only on the top of the tumor is the pigment epithelium defective. The nonpigmented layer of the ciliary epithelium is normal only in a small area. In other parts it is detached, but its main part has proliferated to a considerable degree, forming large cystic spaces. The retina is detached on the temporal side. The adjacent choroid is hyperemic. There are no significant changes in the cornea, the iris, or the anterior chamber.

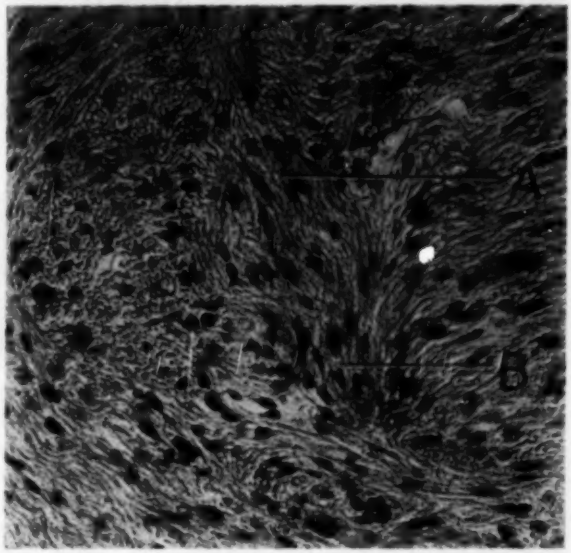

Fig. 2 (Blodi). The cells are arranged in intertwining bundles. The nuclei show a tendency to palisade at A and B.

The tumor itself consists of intertwining bundles of cells with some tendency of the nuclei to palisade in certain areas (fig. 2). This is characteristic not only for the Schwannomas, but also for leiomyomas. These closely packed bundles consist of spindle-shaped cells with rod-shaped nuclei and an acidophilic cytoplasm. The bundles are interlacing and interwoven so that some of them are always cut transversely. Only a few of the cells have larger, irregularly formed nuclei. But there are hardly any mitotic figures, nor are there any other signs of malignancy.

The tumor is very vascular. It contains numerous capillaries, but also larger vessels. The vascular layer of the ciliary body can be seen around a large part of the muscle tumor.

Masson's trichrome stain shows that the tumor stains with the characteristic purplish color of the muscle tissue. Moreover, the presence of fibrils can be shown with this stain. These can be seen as fine and separate fibers among the cells, fusing to coarser fibers terminating the cells, and they undoubtedly represent myoglia fibril according to their morphology and staining properties (fig. 3). There is only a small amount of collagenous fibers within the tumor, which accompany the vessels and form an irregular network of septa. But there is a considerable increase in connective tissue toward the periphery of the tumor.

Discussion

The tumor of the ciliary body which we have described above has all the characteristic features of a smooth-muscle tumor. It is a well-demarcated, mature tumor which appears benign in the histologic picture. It consists of intertwining bundles of the typical spindle cells with rod-shaped nuclei and an acidophilic cytoplasm and a considerable amount of intercellular fibers. The staining reaction, the presence of myoglia fibers, and the palisading of the nuclei confirm the diagnosis.

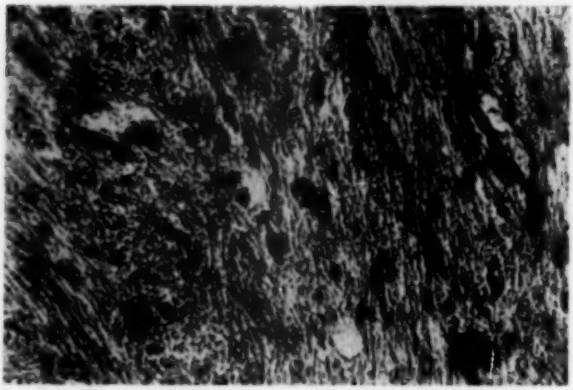

Fig. 3 (Blodi). Myoglia fibrils among the cells (Masson's trichrome stain).

The leiomyomas are benign tumors with a slowly progressive growth. They cause only mechanical symptoms in other parts of the body. But even benign intraocular tumors may have a deleterious effect on the eye, as can be seen by the complications of the more frequent hemangioma of the choroid. Especially when situated in the ciliary body such histologically benign tumors may cause retinal detachment or secondary glaucoma and the eye will be lost in most cases.

It is very difficult to make a clinical diagnosis of a leiomyoma of the ciliary body. The slow growth of the tumor in the early stages will not cause any symptoms, nor will the tumor be detectable by a routine examination. Impairment of vision or pain may later follow rather suddenly and so simulate in every respect a malignant growth. The color of the tumor will usually be rather dark, as the pigment epithelium over the mass remains unchanged and may even proliferate. An enucleation of the eye will therefore be the method of choice in treating these suspicious tumors. It may be that in cases in which such a tumor might be suspected clinically or in patients in which the only eye is affected a partial excision of the ciliary body could be done, as described by Lindner for a malignant melanoma of the ciliary body.

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POSTERIOR INCISION OF CORNEA*

SURGICAL TREATMENT FOR CONICAL CORNEA AND ASTIGMATISM

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In April, 1939, I reported an operation under the title, "The treatment of conical cornea: Incision of Descemet's membrane,"[1] which had been thought of and studied during my research work on conical cornea. Since then, its technique has been improved and its indications have been extended.

The present paper reports the most recent method of the surgical treatment for conical cornea, astigmatism, keratectasia, and deformities caused by postinflammatory partial expansion of the cornea.

In treating conical cornea,[1,2] it is necessary to operate on the conical apex; thus, a nubecula will naturally be produced in the pupillary region. This corneal opacity is, however, negligible, as it soon fades away and the vision will be much improved. The operation will never cause a large leukoma, as is caused by cauterization, which may call for tatooing or iridectomy later on.

The posterior incision made close to but not in the pupillary region will not result in a complete cure of conical cornea. In animal experiments, however, it was possible to produce traumatic regular astigmatism to some extent without creating opacity in the pupillary region.[4] The result of these animal experiments has been applied to the correction of astigmatism of human eyes.

If, in a case of astigmatism, another astigmatism is artificially produced by the posterior corneal incision, so that the axis of the existing astigmatism and that of the produced astigmatism meet at right angles, these two astigmatisms will be mutually compensatory. There is no difference in the effect of surgical treatment between corneal and lenticular astigmatism.

If scar tissue is formed in the deep stratum of the cornea, as in the keratitis sclerotica, it will produce an aplanatic cornea and the corneal curvature will diminish to some extent, causing far-sightedness. When the corneal surface is injured as in pannus or ulcus cornea, it will give rise to keratectasia and myopia. As is well known, an injury of Bowman's membrane causes less effect on refraction than an injury of Descemet's membrane. In order to get a marked and permanent improvement of corneal refraction without an ugly scar, the incision should be made on Descemet's membrane.

In two cases, this new operation seemed to be especially indicated. The progress of a spontaneous rupture of Descemet's membrane, in a girl, aged 16 years, with conical cornea, was observed from its beginning when there was a wide opacity in the cornea. With subsidence of the rupture, however, the corneal distortion was considerably corrected and the vision was much better than it had been before the rupture.

The second case was that of an American boy, aged 16 years, who came to Japan for the treatment of a conical cornea of his left eye. Although this eye had a rent in Descemet's membrane, its vision upon recovery was better than that of the right eye which later developed a conical cornea. The right eye had no rent and the other symptoms were less serious than those of the left eye.

My studies show that there are two kinds of corneal opacities in the conical corneal:[3] (1) Hyaline degeneration which occurs gradually from the surface of the cornea. (2) Interstitial opacity which is suddenly produced by the rutpure of Descemet's membrane (due to the infiltration of the liquor camerae). In the latter case, the opacity soon fades away, resulting in the recovery

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of the refractory disorder. This was clearly shown in records of 22 cases.

Since it has been shown that the conical curvature will be reduced to a considerable degree following the spontaneous rupture of Descemet's membrane, although the vision may or may not be regained, the operation I have developed calls for an artificial rupture.

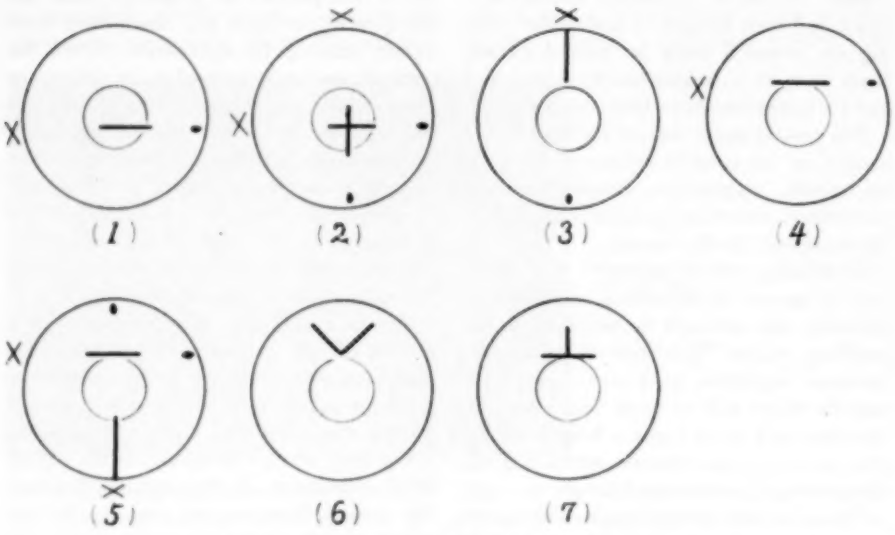

Fig. 1 (Sato). Steps in posterior incision of the cornea.

Various methods of posterior incision

Two methods of operation for conical cornea and three for astigmatism are in use.

For the treatment of conical cornea either a single or a cross-wise incision is made (fig. 1). Figure 1-1 and -2 show that, if the incision is made on the posterior surface of the corneal apex (and if proper postoperative treatment is given), the corneal deformation can be corrected to a great extent, while the refractory disorder can be reduced remarkably. The opacity produced by this operation will never disfigure the eye, nor will it impair the vision.

Three methods of operation for astigmatism are shown in Figure 1-3, -4 and -5: The radial incision (fig. 1-3), cutting the meridian of the cornea from the limbus to the edge of the pupil; the tangent incision (fig. 1-4), cutting on a line tangent to the pupil; the combination of these two methods (fig. 1-5).

The T-incision and the V-incision, as shown in Figure 1-6 and -7, are not satisfactory, for they tend to create wide separation of Descemet's membrane, thick opacity, and irregular astigmatism.

The radial method (fig. 1-3) will reduce the refractive power of the corneal meridian along which the incision is made. In animal experiments, the error produced by this method was as high as four diopters and it lasted for a period of several months to one year. In most of the human eyes, the effect, although limited to no more than two diopters, was more prolonged. In one case, an observation period of 10 months showed no recurrence of symptoms. This radial method is suitable for a moderate myopic astigmatism.

In direct astigmatism, a vertical incision should be made on the upper part of the pupil so that a nubecula will be hidden behind the upper eyelid. If the astigmatism is not extreme, this method is better than the tangent incision.

The tangent method will reduce to a large extent the refractive power of the meridian which meets the incision line at right angles and will increase the refractional power of the meridian parallel to the incision line. Clinically, careful observation will sometimes show a healed traumatic rupture of the Descemet's membrane, which was caused by a forceps delivery at birth, with a refractive power similar to that found after operation by the tangent method.

In an animal experiment, one instance in which the tangent method was used showed a minus 3.5 diopters in the direction parallel to the incision line, and a plus 4.0 diopters, in the meridian with which the incision line met at right angles—a total of 7.5 diopters. This error had not decreased even after eight months. Clinically, it was not rare to see an effect up to four diopters.

The standard length of this incision is approximately four mm. However, experience reveals that the deeper the incision, the greater the plus effect, and the longer the incision, the greater the minus effect. For astigmatism, the diameter of the pupil is assumed to be four mm., when the tangent method is used. The tangent method is suitable for an advanced myopic astigmatism as well as for a compound astigmatism. For a direct myopic astigmatism, the incision is made on the upper range of the pupil.

Results of the operation

Between 1938 and 1943, there were comparatively many cases of conical cornea caused by incorrect treatment of myopia in Japan. Of about 200 cases of posterior incision of conical cornea, there was not a case which operation made worse. In almost all cases, there was improvement of vision and refraction. Prof. S. Komoto[5] and Dr. N. Kirisawa[6] have expressed their belief in this operation.

Outlining the result of operations for astigmatism in earlier cases: Of 19 operations, there were three with no effect; four with correction between 0.5D. and 0.75 D.; seven of 1.0D.; one of 3.0D.; three of 4.0D.; and

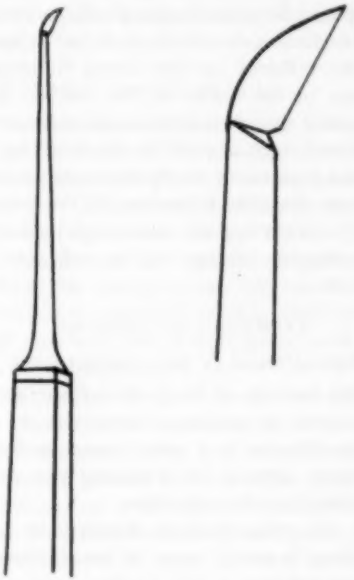

Fig. 2 (Sato). Sato's corneal lancet. The length of the blade is two mm.

one of 6.0D. (the last case was indefinite because of nubecula).

It is natural that the naked-eye vision can be improved, for astigmatism can be palliated. In some cases, corrected vision is further improved.

Not infrequently there may be found a corneal opacity following the posterior partial incision, but it will become a faint line after one month or so. Therefore, no patient will be inconvenienced by its presence.

Refraction in the cases just mentioned was measured through conscientious correction by means of lenses in cases of the conical cornea and it was measured closely in 4 or 8 meridians by means of Gulstrand's re-

fractometer (Zeiss) in cases of astigmatism. In animal experiments (rabbit), the sciascope was used. However, an error is apt to be made by sciascopia on animals. Therefore, the utmost attention should be given to this possibility.

My method used on animals was published in the medical report of Juntendo Hospital.[4] To give the gist of the technique, the examination is to be made so that an image of the reflector on the cornea is situated always in the center of the cornea. It is necessary that the test lens and reflector be combined with a cord 50 cm. long for an animal experiment. Such sciascopia does not indicate the true refraction of the animal, but it is a correct and convenient method in observing the change of the refraction at each step.

Technique of operation

A. Precautions in the performance

The incision of the posterior surface of the cornea by passing a lancet into the anterior chamber is a novel operation but is perfectly safe, if the following five points are taken into consideration.

1. The point of lancet should never touch the lens. It should never be turned towards the lens during the operation. At the time of penetrating through the cornea or withdrawing therefrom, if it is kept always horizontally with its blade parallel with the surface of the iris, while in the eye its point is toward the cornea, it will never touch the lens.

2. Choice of a lancet. My corneal lancet, (manufactured by the Handaya & Co., The R. Takada & Co., Tokyo) must be used. As is shown in Figure 2, its blade is small, the width of the blade is narrow, and its neck is relatively thick. Therefore, the aqueous will not leak out of the wound when incision is made, and it can be used slowly and freely during the operation. The blade of a corneal lancet must have a proper angle. If it is bent too much, it would be difficult to operate an astigmatism. If its angle is insufficient, it would be inconvenient for the operation of conical cornea.

3. Incision. The point at which the cornea is penetrated must be located about 0.5 mm. from the limbus corneae toward the corneal center. Then the lancet can be used very easily within the anterior chamber. If the incision is made outside of the limbus, it would be difficult to perform the operation.

4. The pupil should be kept contracted before the operation.

5. Sufficient light is especially necessary.

B. Preparation for the operation

Refraction of the eye should be tested both objectively and subjectively. In case of astigmatism, close examination of the astigmatic axis should be made. Anesthetic is applied locally by dropping cocaine solution. In addition to my especially designed corneal lancet, a gray human hair is necessary.

C. Operation of conical cornea

Since it would become difficult to find the corneal apex after the operation had been started, the location and the form of the apex must be understood prior to the operation.

As is well known, the apex is the thinnest part of the cornea. It is not in the middle of the cornea and is generally found at the point of the incision line in Figure 1-1 and -2. Place a gray hair exactly on the cornea at the point where the incision is to be made, with the forceps. The corneal apex is found usually as a short dull edge, lying almost horizontally. Accordingly, the location of the hair must be nearly horizontal. The gray hair is used as a guide for the incision. A silk thread, a rabbit's hair, a horse hair, a human black hair, and tattooing have been used. But a gray human hair is the best, because it is most conspicuous. The hair should be cut to the length of the incision to be made (3 to 4 mm.) and be placed properly.

The conjunctival limbus is held with a

lock forceps at the point marked with a cross, as shown in Figure 1. Then thrust the corneal lancet into the anterior chamber, from the point of the dot marked deep into the eye until the point of the lancet has passed the guiding mark of the gray hair. The incision is made along the hair as the lancet is drawn out.

In carrying out a proper incision, the corneal lancet should be used with sufficient force, as the cornea is rather tough, not easily broken through, and a small perforation, if it occurs, does no harm. The length of the incision depends on the severity of the disease, but usually from 3 to 4 mm. is sufficient.

In carrying out a crosswise incision, the horizontal incision is done first, and three or more days later the vertical incision should be made. In this case, the upper (or the lower) conjunctival limbus is held with a lock forceps, and the eyeball should be forcibly made to look up (or down). Only one Desmarch's lid opener is used on the lower eyelid (or upper eyelid), and the equator of the eyeball is exposed as closely as possible. Then the corneal lancet is driven into the eye from the point as marked in Figure 1. If the corneal lancet is held as usual, the vertical incision can hardly be made satisfactorily. It must be held with the thumb, the forefinger, and the middle finger, as if picking up a cigar out of its case.

The operation can be performed very easily, if the operator views the patient's cornea from in front as exactly as he can. For the vertical incision, particular care should be taken for sufficient light. Our experience shows that better results have been obtained when the vertical incision was made shorter than the horizontal. If the vertical incision is difficult, double or triple horizontal incisions may be substituted.

When the corneal lancet is withdrawn from the anterior chamber, the corneal incision opens by itself and becomes spindle-shaped within a minute. A crosswise incision brings about a diamond-shaped or a kiteshaped rupture of Descemet's membrane. On the day following the operation the aqueous will infiltrate into the interstitial stratum of the cornea, resulting in opacity at the corneal center around the incision. But most of this opacity will be absorbed within several weeks, leaving only a narrow nubecula.

D. Operation for astigmatism

For astigmatism, the operative technique is just the same as for conical cornea, but operation is at a different place. In the operation for astigmatism, it is important to select the right place exactly. Place a gray hair exactly on the intended position and perform the operation carefully so that an incision will contact or be tangential to the pupil and will have exact angles with the axis of the astigmatism.

The depth of incision presents an important problem. The examination of human eyes by means of the Spaltlamp-Hornhaut microscope (Zeiss) and histologic study of animal corneas would seem to indicate that an ideal depth for the incision is to cut half of the interstitial layer and not to break Bowman's membrane. However, even a deep incision results in almost no harm and, if the incision was too slight, it can be repeated after several days.

Upon examining a number of cases operated on by my colleagues, I have found that the incisions were not deep enough, even Descemet's membrane was not being incised sufficiently in some cases. Therefore, it is better to make the incision slowly but with proper force. When the cornea is noticeably thin in a case of conical cornea, it may be easily perforated by operation. Even then it usually takes several seconds before aqueous is lost. If perforation takes place, use the corneal lancet with less force, cut the desired length, and draw the lancet out before great loss of aqueous occurs. Per-

foration caused by the operation will result in no harm.

If there is any danger of prolapse of the iris after the withdrawal of the lancet, the iris should be reduced by tapping the wound with a spatula, and miotics or mydriatics should be used. However, I have experienced such a case only once.

If the operation is difficult because of an oblique axis of astigmatism, the following supplementary method may be useful. Attach a silk suture to the upper and the lower sclera (to the tendon of the superior and inferior rectus) and have an assistant pull them in opposite directions. If the eyeball is thus twisted, the axis of astigmatism can be changed to a position more convenient for operation.

E. Postoperative treatment

For conical cornea, the after-treatment should be continued for one month with miotics and a pressure bandage. For the first five days, at least, the bandage must be aseptic. It takes 2 or 3 months before spectacles can be prescribed.

For astigmatism, an aseptic bandage with a protection board is used for a week. The prescription of spectacles may be made after two weeks. A pressure bandage and miotics are of no value.

Summary

1. The posterior incision of the cornea is a new method of operation in which the cornea is incised from its posterior surface by passing a lancet into the anterior chamber. This operation is definitely effective in altering the refractional radius of the cornea. I have been getting satisfactory results from this method of treatment for conical cornea, astigmatism, and keratectasia.

2. Irregular astigmatism, strong nearsightedness of the conical cornea, can be cured or improved by a posterior incision made at the corneal apex. For a moderate case, a single incision, and for a serious case, a crosswise incision is indicated. By this method, not only the vision of the naked eye, but also corrected vision can be improved. It is equally effective for keratectasia.

3. Astigmatism may be satisfactorily corrected, if the tangent or the radial method of operation is used, provided that the pupillary region of the cornea is not affected. Regular astigmatism of more than two diopters, regardless of its kind, is indication for this operation.

4. For regular astigmatism, which cannot be corrected by spectacles (a strong astigmatism of an oblique axis), this operation offers the only remedy.

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MELANOMA OF THE IRIS*

A REVIEW WITH A REPORT OF A CASE

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In 1939, Doherty[4] estimated that there were 175 cases of melanosarcoma in the literature, added three cases of his own, and included a bibliography for the years 1919 to 1937.

Since then, 24 additional cases of melanosarcoma of the iris have been reported, 23 verified by microscopic examination of the excised tumor or of the enucleated eye. The case reported by Mitchell and Knott[11] was treated by radon, since the patient had only the one eye. The case reported by Levitt,[8] is most interesting as an example of how difficult the diagnosis of this entity can be; microscopic study of the enucleated eye found no malignancy, but perforation of the cornea, prolapse of iris, iritis, and redistribution of pigment. The choice of title was unfortunate, and it is not included in this series.

CASES REPORTED IN LITERATURE

These 24 additional cases in the literature were those of patients whose ages ranged from 10 to 72 years, with most cases in the age group between 35 and 55 years. There were more female than male patients. None of the cases had a significant history of trauma.

ORIGIN OF TUMOR CELLS

The problem of the origin of the tumor cells in melanosarcoma is still as unsettled as ever and conflicting opinions continue to be expressed in the literature. Von Recklinghausen (1882)[3] believed the essential neoplastic cells to be endothelial; Acton (1922)[5] suggested mesoblastic chromatophores; and a third view combined these two. Masson (1926-1931),[5] in work verified by many others, ascribed a neurogenic origin to melanomas of the skin, and Theobald (1937),[3] from a study of seven eyes, concluded that there is every reason to believe that the malignant tumors of the uveal tract, pigmented or not, are essentially neoplastic developments from the cells of Schwann and therefore ectodermal in origin.

Becker (1934),[2] from his histologic study of melanomas of the skin, said that melanoma is probably benign or malignant proliferation of the melanoblasts normally found in all pigmented epidermis, and Reese (1944)[15] believes both benign and malignant melanomas in the eyes arise from mesodermal melanoblasts.

Agatston and Gartner (1939),[1] believe the origin of melanomas of the eye to be probably neuro-ectodermal, while Siegert (1938)[21] believes sarcoma of the eye may be considered with overwhelming probability to be of mesodermal origin; Martin-Jones (1946)[9] expresses the same opinion, although not so forcibly. Tooke[22] goes one step further and supports the theory that melanoblasts in the stroma of the iris are at least sometimes epidermal in origin.

Finally, Wolff (1948)[24] suggests nevus should be regarded as a composite or mixed tumor, consisting of nevus cells, epithelial cells, and branched chromatophores. Each of these may proliferate alone, or with the others and produce a malignant pigmented tumor. The final structure will depend on the proportions of the three types of cells.

AREA AFFECTED

Of the 24 cases collected, three were diffuse melanosarcoma of the iris, also called ring or annular melanosarcoma, nine were

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limited to the iris alone, and the remainder involved ciliary body or cornea.

Only one case[22] is melanosarcoma without pigment, also called leukosarcoma. It is generally agreed now that the essential pathologic findings in melanosarcomas are the same regardless of the presence or absence of pigment.

Types of cells

The cell type was reported as spindle cell in more than half of the cases; the others included mixed cell (oval and epitheloid, polygonal, and stellate), polygonal cell, and oat-shaped cell types.

Treatment of cases

It is of interest to note, in the treatment of these cases, that there has been considerably less hesitancy in choosing iridectomy rather than enucleation in those instances where the location of the tumor on the iris is such that iridectomy seems to promise a means of complete extirpation of the tumor, and thus salvage a useful eye.

In all cases in which there was involvement of the ciliary body or cornea, with the exception of Schmid[20] and Mitchell and Knott,[11] or glaucoma, or the ring type of melanosarcoma, the eye was enucleated. Schmid attempted extirpation of a tumor, extending from the chamber angle toward the pupillary margin and touching the posterior surface of the cornea. There was a recurrence in the sclera near the operative scar in three years.

In one of Neame's[12] cases, immediately on examination of the tumor, the pathologist reported excision as incomplete, and the eye was treated with unscreened radium, with no apparent recurrence in two years and nine months.

Nomenclature

A word about nomenclature of the type of tumor here discussed may be useful. In the 21 papers using the name of the tumor in the title, the following eight names were found: melanosarcoma, sarcoma, annular sarcoma, malignant melanoma, melanotic sarcoma, leukosarcoma, diffuse malignant melanoma, and just melanoma. May I here insert a plea for an attempt to standardize the name. It would be particularly helpful if editors would insist upon use of the standards adopted, especially in titles of papers.

Report of a case

History. O. C., a 52-year-old white man, was admitted on February 2, 1949, to the Veterans Administration Center at Bath, New York, for treatment of a tumor of the iris of the left eye.

One month before admission this patient visited Dr. A. Wahlig in Bath, New York, to have his glasses checked. Dr. Wahlig noticed the black pigment spot on the iris and found, in addition, under the slitlamp, a tumor of the iris adjacent to the pigment spot. I saw the patient in consultation with Dr. Wahlig and we both agreed that the tumor should be excised.

There was no definite history of trauma to or inflammation in the eye at any time and patient was unaware of the presence of the tumor, but had seen the pigment spot, which he stated remained unchanged in size since he first noticed it about 30 years ago. There is no family history that is pertinent.

Physical findings. Other than the pathologic condition in the left eye, physical examination disclosed nothing of note. The visual acuity was 20/20 in both eyes. The pupils reacted to light and accommodation; the right pupil was round and regular, the left was slightly irregular below. The left iris showed, at the 6-o'clock position, a small tumor, two mm. in size, nonpigmented, cystic in appearance, with many small loops of fine vessels, involving the pupillary border and extending downward about two mm., leaving the outer half of the iris apparently uninvolved.

The upper portion of the tumor encroached into the pupil. When first seen one month earlier, there was no apparent en-

croachment into the pupil. Adjacent to the tumor at the 5-o'clock position and on the pupillary border was a small pigmented spot, one mm. in diameter (fig. 1).

Treatment. On February 10, 1949, the whole of the tumor and the adjacent pigment spot were removed by a wide, basal iridectomy. Several days later a small fragment of iris was seen floating freely in the anterior chamber. Since it could not be determined whether this was benign tissue or a fragment of the tumor, the eye was reëntered and the fragment irrigated out. It was so small that it could not be found for microscopic study.

Fig. 1 (Feldberg). Melanoma of the iris at the 6-o'clock position, with a benign pigment spot adjacent at the 5-o'clock position.

The patient made an uneventful recovery, his vision remains 20/20 in the left eye, and there is no apparent tumor tissue in the iris.

Pathologic report. Gross examination: specimen consists of a pinhead-sized biopsy fragment of grayish-white tissue removed from the left iris.

Microscopic examination (Dr. Otto Munch of the Veterans Administration, Bath, New York): most of the peripheral zone of the specimen is seen to be composed of a well-vascularized, loose, and dense collagenous connective tissue with a spotty surface lining of melanin pigment and melanoblastic cells. The remaining stroma embeds irregular islands of large tumor cells, mostly spindle-shaped in character, but tending in spots to become polyhedral and epithelial in appearance.

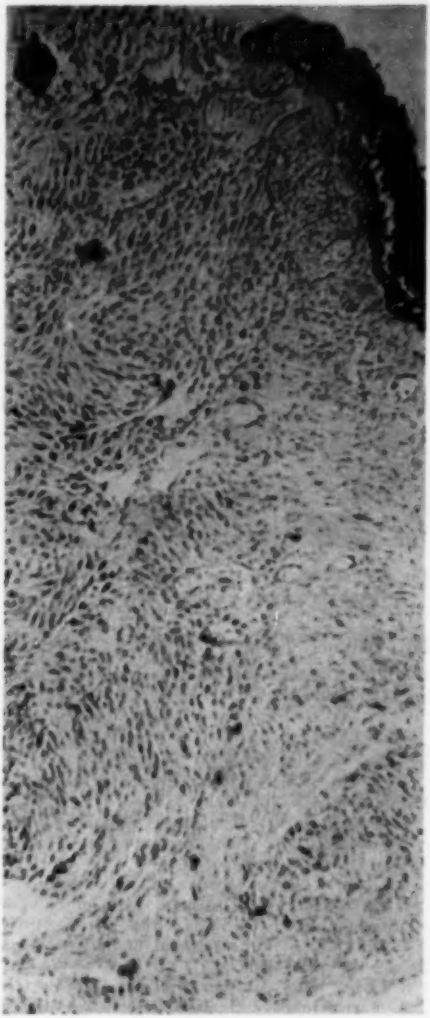

Fig. 2 (Feldberg). Section of melanoma of the iris and pigment spot. There is no pigment in the tumor. (×50.)

The tumor cells are arranged in characteristic alveolar formations, contain an abundant clear cytoplasm and enlarged hyperchromatic, vesicular nuclei. Very little, if any, melanin pigment is present in the proliferating tumor area. The tumor is quite vascular, and tumor cells are seen crowding the vascu-

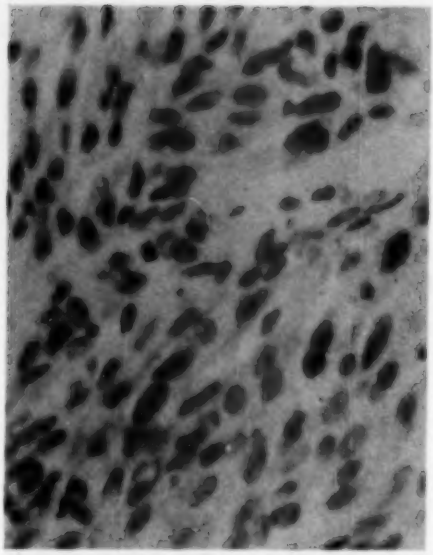

Fig. 3 (Feldberg). Section of melanoma of the iris. There is no pigment in the tumor. (×250.)

lar channel lining. Pathologic diagnosis, malignant melanoma of iris (leukosarcoma) (figs. 2 and 3).

Dr. Arthur P. Stout of New York, and Dr. Oscar Auerbach of New York, after studying additional trichrome-stained sections, agreed with the diagnosis of malignant melanoma of the iris, as did Dr. W. B. Hawkins and Dr. John Gipner of Rochester, to all of whom I am grateful for their efforts in establishing the diagnosis.

Because the tumor is apparently completely extirpated, and because of the excellent vision in the eye, no further surgery is contemplated; but the patient has been advised that he must, wherever he is, have periodic eye examinations by competent ophthalmologists.

Summary

1. Twenty-four cases of melanosarcoma, appearing in the literature from 1938 through 1948 have been collected and discussed.

2. A case of melanosarcoma, without pigment, of the iris is reported.

3. A review of present trends of thought about the origin of tumor cells in melanosarcoma of the eye is presented.

Veterans Administration Center.

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A NEW REMOVABLE AND PERMANENT ORBITAL IMPLANT*

A PRELIMINARY REPORT

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The orbital implant to be described in this paper is based on fundamental surgical principles and should be permanent, with little or no chance of late extrusion; it can be removed and reinserted by the patient as often as desired and makes better socket hygiene possible.

The implant† is a semicircular gold band with a straight gold band bridged vertically across the two ends; the straight band is hinged to one end of the curved piece, and snaps into the other end. The straight band has a square hole (three mm. in diameter) in its midsection for reception of a similar square peg which is fused on to the back of the prosthetic eye (fig. 1).

The socket is prepared for the implant by creating a skin-lined, semicircular tunnel in the back of it. This tunnel is vertically placed, with its lower mouth just back of the tarsal border of the lower lid, and its upper mouth about three mm. below the apex of the superior sulcus of the socket. The midsection of the tunnel is posterior to the fused or sutured ends of the extraocular muscles.

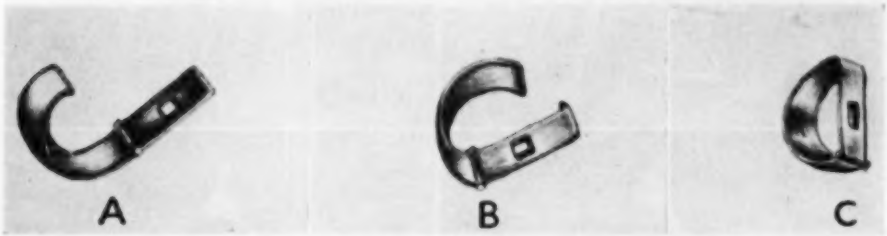

Fig. 1 (McDowell). The semicircular gold band implant. The implant is inserted (by the patient) with the bar open as shown in (A). The bar is then hinged up and snapped shut (B and C).

To insert the implant, the vertical bar is unsnapped from one end of the semicircular ring and hinged out to a straight position; using the bar as a handle, the free end of the

* From the Department of Surgery (Division of Plastic Surgery), Washington University School of Medicine.

† Manufactured by and obtainable from the H. C. Lahay Specialties Company, 4457 Forest Park Boulevard, Saint Louis, Missouri.

semicircular ring is introduced into the lower mouth of the tunnel and then on up through the tunnel until it just protrudes from the upper mouth; the vertical bar is then hinged upward and snapped in place on the free end of the ring.

When the implant is in place, only the vertical bar is visible. When the patient is asked to look up and down and from side to side, the bar will tilt in the corresponding directions (fig. 2).

As with other implants, the lids are held apart and the gold peg on the back of the artificial eye is fitted into the square hole in the midsection of the vertical bar. The lids are replaced and the movements of the back of the socket are then transmitted to the artificial eye (fig. 3).

Operation for creating the skin-lined tunnel

The tunnel is lined with a thick-split skin graft which is inserted wrapped around a plastic or acrylic form.* Some experimentation is being done to determine the best shape and dimensions for this form. At present, a flattened band (8- or 9-mm. wide and 1-mm. thick) cast in a semicircle (with a 15-mm. diameter) seems best. The entire semicircle should be contained within the tunnel, so that an additional two mm. of plastic material can be added on to each end of the form to protrude a little from each mouth of the

* Created by Mrs. Belle Stockberger, Mager & Gougleman, Inc., Metropolitan Building, Saint Louis, Missouri, who was helpful in many ways in developing this procedure.

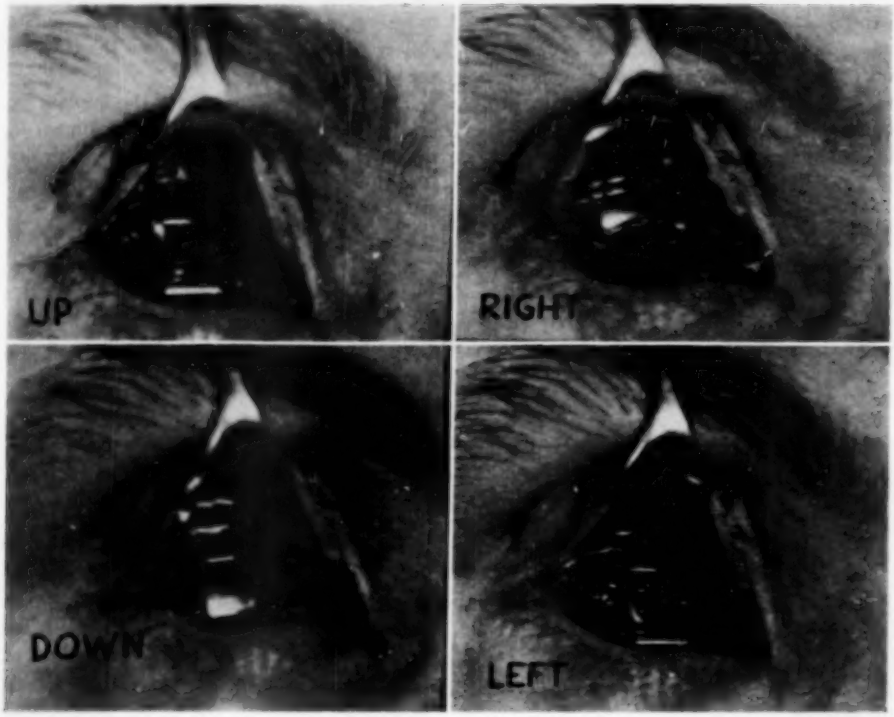

Fig. 2 (McDowell). Photographs showing the implant in place in a socket with the patient looking in the directions indicated. This patient had a badly scarred orbit, but still had some movement as shown. (Same patient as Figs. 4 and 5).

tunnel. A small "eye" or hole can be drilled in each of these protruding ends for reception of a suture.

If the patient has an old, healed socket, an examination is made before the operation to determine the point of maximum movement on the back of the socket. This is usually, of course, the central conjunctival dimple. The amount of movement present is also a rough guide to the amount of movement that will take place with the prosthetic eye, although some movement will be lost in the transmission.

At operation, this central point of movement is marked with a pen and some methylene blue; the proposed tunnel openings are then marked equidistant above and below this point, and as far apart as are the ends of the plastic form.

A stab incision is made at each of the tunnel openings. A hook is then inserted at the central point and it is pulled directly forward; then the tunnel is made by dissection with tiny scissors, going behind the fused ends of the muscles in the center and encompassing as much tissue as the plastic ring will surround. (A blunt-pointed curved iris scissors with blades only about one cm. long is useful for this purpose.) A one-inch plain-gauze nasal pack soaked with 1:5,000 adrenalin is then pulled through the tunnel and left in place about five minutes to stop any oozing.

A split-skin graft of moderate thickness is then cut with a knife from some area where there is a minimal amount of hair and

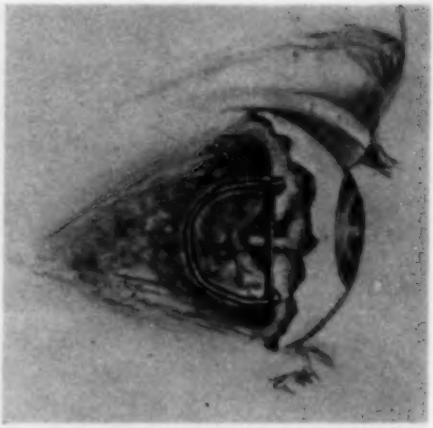

Fig. 3 (McDowell). Diagrammatic side view of implant and prosthetic eye in place in socket. The fused ends of the extraocular muscles should lie within the ring.

sebaceous glands (about half the thickness of the skin from the inside of the lower thigh just above the knee is fairly good). The graft is wrapped around the plastic mold (raw side out) and fastened to it by a stitch through the hole in each end. The gauze pack is removed from the tunnel and the skin-covered mold inserted by pulling one of the stitches through the tunnel. The two end sutures are then tied together in front of the posterior conjunctiva, the socket is packed with gauze surrounded by a single layer of fine-mesh grease gauze, and a pressure dressing is applied over the outside of the lids.

The first dressing is done in 5 to 7 days,

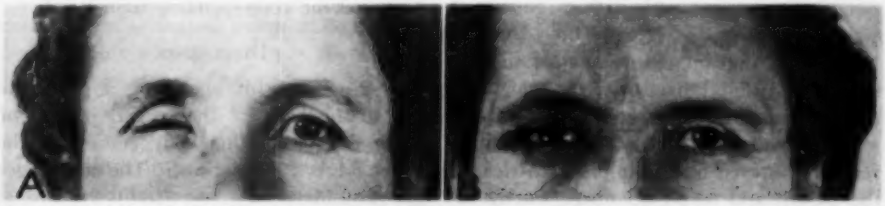

Fig. 4 (McDowell). (A) Condition of patient when first seen. The lower lid was so weak that she could only keep in a tiny floating prosthesis which would not hold the upper lid up or forward. The cosmetic effect was so poor that she wore a patch instead. (B) With the new implant in place and a large prosthetic eye anchored to it. Note how well the upper lid is held up and forward, eliminating the common "sunken" deformity. No strain on the lower lid.

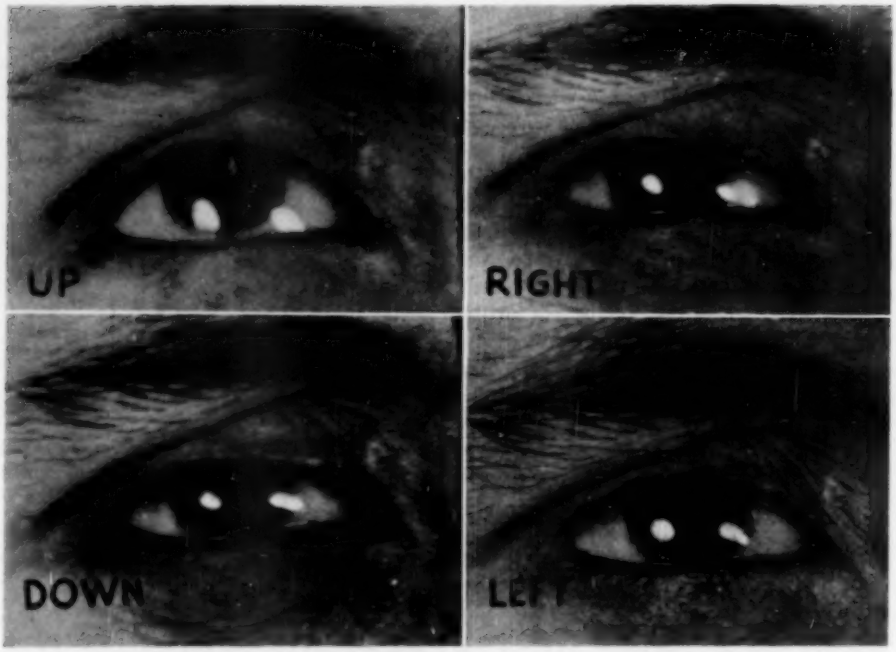

Fig. 5 (McDowell). Same patient as is shown in Figures 2 and 4, demonstrating good vertical movement and slight horizontal movement. This patient had had many operations with insertion and extrusion of glass balls, repeated infections, and so forth, so that her orbital muscles were partially bound in scar. It is thought that even better movement could be obtained in a more favorable initial situation.

at which time the sutures are cut and the plastic mold slipped out. Any excess graft is trimmed off, and the skin-lined tunnel is irrigated with saline. After cleansing, the plastic mold is slipped back in, and the socket is repacked and a pressure dressing reapplied. This is repeated every second day until two weeks after operation, at which time the permanent gold implant is inserted and an eye fitted.

The gold implant should be just slightly thinner and slightly narrower than the original plastic form, and should be perfectly smooth on all edges. The patient is taught to remove the eye and the implant, to cleanse the socket, and to replace them, but is instructed never to leave the implant out more than an hour during the first few months.

A similar technique should be useful at the time of enucleation, simply placing the skin-wrapped plastic mold in the depth of the cavity and then suturing the four muscle ends together in front of it. It might be desirable to shorten some or all of the muscles so that they would fit tightly across the anterior surface of the tunnel. One could also consider splitting the ends of the superior and inferior recti so that they could surround the corresponding tunnel ends.

Discussion

The principle of anchoring a prosthetic eye to the back of the socket, instead of using it as a floating body resting on the lower lid, is a real advance. The advantages are twofold.

1. Movement. Some movement may be present with a floating prosthesis, depending upon the amount of effective friction between the back of the socket and the back of

the eye, but better movement is possible when the eye is anchored to the back of the socket.

In the latter instance, the amount of movement in the prosthesis will still be limited by the amount of movement present in the back of the socket—the best possibilities are present in fresh enucleations without infection, and the poorest in old sockets where there have been repeated infections and extrusions of glass balls, other implants, and so forth.

The vertical movements will probably always be superior to the lateral ones, because of lack of any medial fornix near the caruncle to permit medial rotation of the prosthetic eye. The implant described here will also lose some of the vertical movement if it is loose enough to "cradle" during such movements.

2. *Effect on the lids.* Anchorage of the prosthesis to the back of the socket permits the eyemaker to build out the top of the prosthesis and bring the upper lid forward and eliminate the common "sunken" deformity in this area. Attempts to do this with a floating prosthesis simply put more weight and pressure downward on the lower lid and hastened the natural tendency of the lower lid to sag down and forward.

Even with a small, floating prosthetic eye which allowed the upper lid to sink in, many patients have found that the constant weight and pressure on the lower lid have caused it to sag in an unsightly manner after a period of years.

These beneficial effects on the lids should make an orbital implant worth-while even in those patients who do not have any appreciable movement in the back of the socket.

Advantages of this implant

It is against surgical and physiologic principles for a foreign body to remain partially buried in the body tissues indefinitely, regardless of the material in the foreign body. The more inert the material, the longer it may remain, but those of us who have worked a good deal on the problem of burying foreign materials feel that an implant will always work out eventually. We also know that it often takes two or three years to do this, so that the retention of such an implant for a year or two is not a final test. There is some evidence that some conjunctival epithelial cells creep in and partially surround some of these spherical implants, but one would not expect them to have much "wearing" quality in the presence of friction.

The implant described in this paper lies in a skin-lined tunnel and is thus external to the body (in the same sense as an artificial eye or a dental plate is). A skin-lined tunnel will tolerate considerable friction over a long period of time. This has been amply demonstrated in the skin-lined tunnels which have been made through the forearm muscles to activate cineplastic hands.

Skin in an eye socket is always undesirable, but the amount that is in contact with mucosa here is minute—just around each mouth of the tunnel. Since the implant can be removed, and the tunnel washed out from time to time, it is thought that these sockets will remain cleaner than those containing irremovable spherical implants surrounded by raw surfaces that discharge.

Case report

The woman illustrated in this paper had an enucleation 15 years ago following a traumatic injury. Up until the present operation, she had never been able to wear a prosthetic eye. She had had many operations elsewhere in the socket with mucosal grafts, insertion and extrusion of glass balls, and so forth, so that there was a good deal of scarring throughout the orbit and lids.

Following the operation and insertion of the implant described here, she was able to wear an eye with a good cosmetic result—though perhaps not as good as could be obtained in a more favorable initial situation. The upper lid was full and well forward and there was not any strain on the lower lid (her lower lid is thicker than usual from

fascial strips through it and mucosal grafts to it which had been done by previous operations elsewhere).

She has been able to transmit about 90 percent of the vertical movement of the socket to her prosthetic eye (there is a little "cradling" in her case). She can produce very little lateral movement in her socket, but transmits nearly all of it to the prosthesis.

Summary

A new orbital implant, and the preparatory operation for it, are described. The implant lies in a skin-lined tunnel, is removable, and conforms so well to known surgical and physiologic principles that it is thought that it will not be extruded.

640 South Kingshighway (10).

AUREOMYCIN IN THE TREATMENT OF HERPES SIMPLEX CORNEAE*

A PRELIMINARY REPORT

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Aureomycin in the borate form, used locally, has been reported by Braley and Sanders[1] to be a valuable therapeutic agent for dendritic keratitis. They treated six typical cases which showed beginning associated involvement of the corneal stroma beneath the dendritic figure. In five of their cases, the ulcer was healed in 24 hours and the infiltrate showed a pronounced tendency to disappear. The sixth patient had a recurrent dendritic ulcer and disciform infiltrate in the stroma at the commencement of treatment, and failed to respond.

This report indicates our results in the treatment of 24 cases of herpes simplex infection of the cornea with aureomycin. The aureomycin used in these studies was furnished by the Lederle Laboratories of the American Cyanamid Company. In all cases 0.5-percent aureomycin borate solution was instilled locally. The patients were given freshly prepared solution to use in the affected eye every half hour, day and night, for 48 hours, following which they were given fresh solution.

* From the Francis I. Proctor Foundation for Research in Ophthalmology, Division of Ophthalmology, University of California Medical School. This work was supported by a grant from The Gustavus and Louise Pfeiffer Research Foundation.

SUCCESSFUL CASES

Patient	Age (Years)	No. of Attack	No staining (days)
1. A. H.	48	first	4
2. G. W.	18	first	4
3. A. F.	57	first	4
4. B. F.	3	second	2
5. F. G.	24	second	3
6. G. F.	19	first	4
7. A. J.	26	first	4
8. E. W.	28	first	4
9. M. F.	29	first	4
10. E. C.	32	second	4
11. M. K.	65	first	3
12. G. S.	51	first	6
13. E. J.	26	first	4
14. P. M.	34	first	4

UNSUCCESSFUL CASES

Patient	Age (Years)	No. of Attack	No Result (days)	
15. A. G.	45	second	7	(iodine required)
16. D. S.	32	third	7	(iodine required)
17. E. P.	38	first	7	(iodine required)
18. E. K.	32	fourth	7	(iodine required)
19. B. N.	46	first	8	(iodine required)
20. G. S.	6	first	4	
21. A. B.	66	first	5	(iodine required, no stain 3 days later)
22. A. A.	50	first	24	
23. W. O'N.	68	second	8	
24. R. C.	31	second	8	

DISCUSSION

Some comments are indicated on a few of the cases in the successful and unsuccessful

groups. Case 4 developed a recurrence five months after the initial attack, and was again treated with aureomycin. The ulcer failed to stain after 48 hours' treatment. Case 15 recurred four months after the second attack and failed to respond to local aureomycin therapy.

Case 10 had sustained a welding flash of both eyes and developed symptoms on October 28, 1948. The symptoms had completely subsided by November 5, 1948. On November 15, 1948, there was a severe flare-up in the right eye with a vesicular keratitis which had many features of a herpes infection. Aureomycin was started on November 17, 1948, and the corneal lesions promptly subsided.

The ulcer in Case 21 had been present for 10 days before institution of aureomycin therapy, and failed to respond. After application of tincture of iodine the lesions were healed in five days. Case 22 had a disciform keratitis which showed almost constant activity for one and one-half years. This lesion did not show improvement after 24 days' therapy.

Case 23 had a severe herpetic keratitis in 1946. The infection was finally controlled after a variety of treatments. A recurrence developed two years later. Two courses of aureomycin, administered for four days each time, failed to control the recurrence.

The patient in Case 24 had a severe dendritic keratitis while in the army in 1945. Considerable corneal scarring resulted. He was seen on February 18, 1949, within a few hours after onset of a recurrence. By the following day a typical dendritic ulcer was present. Aureomycin was used and in spite of intensive therapy a disciform opacity developed. He was hospitalized and both local and oral aureomycin were administered. The lesion gradually cleared, and within a month there was little evidence of scarring or activity.

Two months later another dendritic ulcer developed in the same eye and was healed within four days on local aureomycin therapy. This case has been placed in the unsuccessful group because of the failure to respond to local therapy at an early period of the infection. However, when one considers the usual course of disciform keratitis, the drug may be considered to have exerted a beneficial effect.

Case 20 had developed a dendritic ulcer following a severe attack of influenza. X-ray therapy and the thermophore were used, and the process was quieted within five weeks. Three weeks later a recurrence was noted and aureomycin was used for four days. Definite progression was noted during this period.

As a result of the above survey it is noted that aureomycin may be expected to cure approximately 60 percent of the cases of dendritic keratitis which are encountered in routine practice. By a cure we mean that there should be regression of symptoms and an absence of staining of the ulcer by at least 6 or 7 days after onset. These results in themselves are not dramatic but when the previous effect of most medications on virus infections is considered they indicate that aureomycin is definitely effective. Equal results may be obtained by the time-honored application of tincture of iodine. It is conceivable that these two methods of therapy may supplement each other. If the lesions fail to respond within a reasonable period on local therapy with aureomycin, tincture of iodine should be applied.

The failure of some dendritic ulcers to respond to aureomycin therapy may be explained by a variation in the virulence of the causative virus. Rapid healing does not always follow early institution of this method of treatment since several of the above cases which failed were seen and treated on the day of onset of the infection. Conversely, several other cases had been active for several days before institution of therapy and responded rapidly.

These results may be compared to those reported by Gundersen.[8] In his control series, 53 cases were treated with mydriatics

and antiseptics. The shortest period during which any one cornea stained was 10 days and the longest 43 days. Eleven cases of this series were complicated (keratitis metaherpetic—nine cases; keratitis disciformis—one case; hypopyon—one case). If these 11 cases were omitted from the series, the average staining period was 21 days.

In 87 patients (97 attacks) treated with strong iodine to the ulcer, the average duration of staining was 7.6 days; 85 percent of these cases showed no staining 10 days after treatment, and 72 percent no staining after the fifth day.

Forty-three patients (45 attacks) were treated by iodinization of the entire cornea. They were divided into two subgroups depending upon the severity. Nineteen cases in Subgroup I had an average staining period of 4.2 days; 26 cases in Subgroup II had an average staining period of 28 days. These patients were considered to have a more severe type of infection so were subjected to total iodinization.

Conclusion

Approximately 60 percent of the cases of dendritic keratitis were healed within from 4 to 7 days following local instillation of 0.5 percent aureomycin borate at half-hour intervals.

87 North 6th Street.
450 Sutter Street (8)

Since this paper was submitted for publication 18 additional cases of dendritic keratitis have been treated with aureomycin topically by the same technique. Ten of the 18 responded satisfactorily while eight required iodine cauterization. During this same interval two additional reports[3,4] have appeared in the literature. In the first, aureomycin was reported to have proven totally ineffective while in the second favorable results were reported in all of a series of seven cases, healing having occurred in from 4 to 21 days. Braley[5] has suggested that the original unpurified aureomycin was more effective in dendritic keratitis than the recent, relatively pure preparation.

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Ophthalmic Miniature

The blindspot is by no means so excessively small. At the distance of four paces, it would cover a man's head in the center of your field of view. When Mariotte made this important discovery, it caused so much commotion that the experiment had to be repeated before the King of England in 1688.

Albrecht von Graefe, *Sight and the Visual Organ*, 1872.

NOTES, CASES, INSTRUMENTS

THE CORRELATION OF PERIODIC OPHTHALMIA WITH LEPTOSPIRA AGGLUTININS IN HORSES*

RONALD M. WOOD, PH.D., AND
GARRIE R. DAVIS
Baltimore, Maryland

Woods and Chesney[1] demonstrated that macerated uveal tissue from horses with periodic ophthalmia, after Berkefeld filtration, was infective for rabbits and after six transfers in rabbits would reproduce the disease in normal horses. Cultures of these filtrates were bacteriologically negative by the usual methods of examination.

Burky and co-workers[2] isolated Brucella from the blood and cystic ovaries of three horses with periodic ophthalmia and demonstrated Brucella agglutinins in the blood serum of afflicted horses. This suggested Brucella is a possible cause of the disease since these organisms could pass through a Berkefeld-V filter. These authors, however, did not isolate Brucella from diseased eyes, and systemic inoculation with Brucella did not reproduce the ocular disease in normal horses. In an attempt to find a possible correlation between periodic ophthalmia and brucellosis, Jones[3] examined a large number of sera from normal and diseased horses for the presence of Brucella agglutinins but was unable to find any significant correlation. His results were confirmed by Davis and co-workers[4] at this institute.

Rimpau,[5] in 1947, presented evidence which pointed to a connection between periodic ophthalmia and leptospirosis. Heusser,[6] in 1948, found agglutinin titers of 1:400 and above against L. grippo-typhosa, L. pomona, or L. australis, in the blood serum of 78.3 percent of horses with periodic ophthalmia.

In line with the suggestion of these authors we have examined the sera of 30 normal horses and 17 horses with periodic ophthalmia for the presence of Leptospira agglutinins.

TABLE 1

TITERS FOR LEPTOSPIRA ICTEROHAEMORRHAGIAE IN NORMAL HORSES AND HORSES WITH PERIODIC OPHTHALMIA

Status of Disease	Number of Animals	Number Positive in Dilution of				Number Negative
		1:5,000	1:1,000	1:100	1:10	
Active periodic ophthalmia	12	12	4	0	0	0
Quiescent periodic ophthalmia	5	0	4	1	0	0
Normal horses	30	3	1	8	14	4

METHODS

The clinical examination of the eyes was made at the time that the blood samples were taken. The sera were preserved in the frozen state until examined. Serum dilutions used in the titrations were: 1:10, 1:100, 1:500, 1:1,000, 1:5,000, and 1:10,000. The agglutinations were performed using a 10-day-old culture of Leptospira icterohaemorrhagiae (type AB Holland, Wijnberg) as antigen. Hanging drop preparations were made which consisted of a four-mm. loopful of each dilution of serum mixed with a one-mm. loopful of live culture on a coverslip. After an incubation period of two hours at 24°C., the preparations were examined under the microscope by darkfield illumination and the results recorded.

* From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital.

Results and Discussion

The results are summarized in Table 1. Of the total number of horses showing clinical evidence of ocular disease, 94 percent showed titers of 1:1,000 or higher. It is interesting to note that all of the horses in the active stage of the disease showed titers of 1:5,000 or higher; whereas, the horses in the quiescent stage showed titers not exceeding 1:1,000. Of the group of animals considered normal by clinical examination, 13 percent showed titers of 1:1,000 or higher.

These findings raise the interesting question as to whether Leptospira are causally related to periodic ophthalmia. This can be definitely demonstrated only by the isolation of the organisms from diseased eyes and the experimental reproduction of the disease by the same agent, thus fulfilling Koch's postulates. Since Leptospira will pass through Berkefeld filters and are not demonstrable in cultures except by special examination techniques, it is possible that this may have been the filter-passing agent found by Woods and Chesney which reproduced the disease in horses after six transfers in rabbits.

Summary

Agglutinins for Leptospira icterohaemorrhagiae were found in high titer in the serum of 94 percent of horses with clinical evidence of periodic ophthalmia, and in 13 percent of normal horses.

The Johns Hopkins Hospital.

Acknowledgements. The authors wish to express their appreciation for the coöperation extended to them by many of the horse breeders of Maryland. We also wish to thank Dr. John D. Gadd for collecting many of the blood samples. We are indebted to Dr. John Tobie for supplying the cultures of Leptospira used in this study.

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HYALURONIDASE IN THYROTROPIC EXOPHTHALMOS

Report of a case

Maurice Kadin, M.D.
Racine, Wisconsin

The value of hyaluronidase in ocular surgery and diseases has been the subject of investigation during recent months. At the February, 1950, meeting of the Chicago Ophthalmological Society, Dr. James Lebensohn read a paper on "Hyaluronidase in ophthalmology." During his discussion, it was noted that the action of this drug in thyrotropic exophthalmos is at present unknown. Trial of this chemical in a known case is therefore being reported.

Case report

History. Mrs. H. C., a white woman, aged 38 years, was first seen in April, 1949, for refraction, at which time corrected vision was R.E., 20/20, with a +3.5D. sph. ⊂ +0.75D. cyl. ax. 5°; L.E., 20/40, with a +5.5D. sph. ⊂ +1.0D. cyl. ax. 180°.

She had had a thyroidectomy during the preceding month. Vision of the left eye had

always been worse than that of the right, and with the difference in refractive error, a diagnosis of amblyopia ex anopsia, left eye, was made. Both eyes appeared prominent, but not exophthalmic. Tensions were normal. Fundi were normal except for slight tortuosity of the retinal arterioles. Blood pressure was elevated to 180/100 mm. Hg, and she had also been under treatment for "high blood pressure and nervousness."

Basal metabolism rate prior to surgery was plus 49. This fell to plus 16 under treatment, and after surgery the basal metabolism rate was plus 5. She had an uneventful recovery, and it was reported that "exophthalmos," which had existed before operation, subsided. Pulse ranged from 80 to 100, and blood pressure from 180/100 mm. Hg to 200/100 mm. Hg.

Second eye examination. On November 1, 1949, the patient returned complaining of pain and blurring of vision, especially of the left eye. On examination, the corneas were clear, the chambers were shallow, more markedly in the left eye, and tension was found to be: R.E., 31 mm. Hg; L.E., 55 mm. Hg (Schiøtz). Corrected vision was: R.E., 20/20; L.E., 20/100. On pilocarpine and eserine, tensions returned to normal in about two hours. Gonioscopy revealed that the chamber angle of the left eye was closed, and it was not possible to see over the iris bulge. The right chamber angle was visible to the line of Schwalbe. Fields were full in the right eye, and the temporal visual field of the left eye was limited to 10 degrees (1:1,000 white). The orbital tissues felt tense, and there was difficulty in everting the lids. Both eyes were equal, but prominent.

Tensions remained normal in each eye until November 5th, when she returned with marked haze over both corneas. Tension was: R.E., 38 mm. Hg; L.E., 65 mm. Hg (Schiøtz). With DFP and prostigmin, tension fell to: R.E., 24 mm. Hg.; L.E., 37 mm. Hg. Surgery of the left eye was advised.

Operation. Sclerectomy-iridencleisis was done uneventfully, except that a large canthotomy was performed, because it was very difficult to open the lids adequately. On the first postoperative day, a large bleb of conjunctiva presented below the cornea and above the lower lid, which persisted, despite enlargement of the canthotomy, evacuation of fluid, and shrinkage with adrenalin. There was a good iris bleb; the anterior chamber reformed slowly. Tension was: O.U., 19 mm. Hg (Schiøtz). The patient was discharged with edema of both upper lids, much more marked on the left, and the large conjunctival bleb.

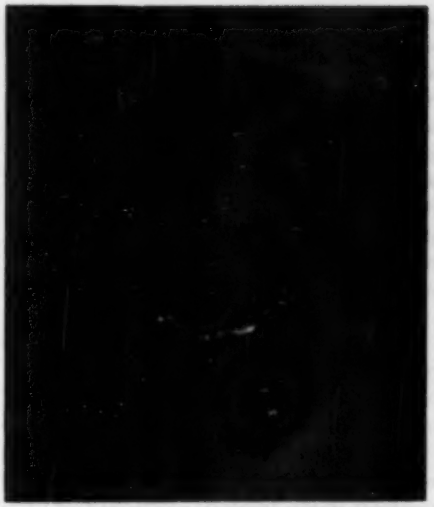

Fig. 1 (Kadin). Use of hyaluronidase increased the edema and proptosis in a case of thyrotropic exophthalmos associated with glaucoma.

Treatment was continued in the office, and a subsequent basal metabolism rate was plus 5. X-ray studies of the skull were negative, with normal sella. Tensions remained normal; the field of the left eye was enlarged (1:1,000 white), and vision of the left eye returned to 20/70. Edema persisted, but gradually subsided somewhat under administration of thyroid extract and iodine and X-ray therapy to the pituitary. The conjunctival bleb flattened, and could be completely evacuated by massage. There was edema of the disc of 3 to 4 diopters.

Hyaluronidase therapy. On February 21, 1950, 250 viscosity units of Alidase (Searle) dissolved in three cc. of two-percent procaine were injected—one cc. retrobulbarly, one cc. into the edematous upper lid of the left eye, and one cc. into the conjunctival bleb and lower eyelid. Following injection little or no change was noted, but within 20 minutes there was definite increase in the amount of swelling and proptosis. There was a three-mm. dilatation of the pupil. Tension prior to injection was: R.E., 24 mm. Hg; L.E., 22 mm. Hg; after 20 minutes it was: R.E., 24 mm. Hg; L.E., 16 mm. Hg (Schiøtz). There was no change in vision.

After one hour, there was definite increase in edema of the lids of the left eye and conjunctival bleb, and there was pronounced increase in the proptosis of the left eye. The edema and proptosis of the left eye remained greater after 24 hours, and also an increase in the swelling of the upper lid of the right eye was seen. Swelling and proptosis returned to the level previous to the injection in 48 hours, and there has been no change subsequent to that time.

SUMMARY

A case of thyrotropic exophthalmos with glaucoma is reported. Use of hyaluronidase increased the edema and proptosis.

535 Main Street.

A METHOD OF PREVENTING CONTACT CONJUNCTIVITIS*

J. MATHEWS ROBISON, M.D.
Houston, Texas

The device used as a part of this method was designed to facilitate the application of drugs to the cornea without allowing the drugs to come in contact with the bulbar conjunctiva and palpebral skin. Its use has made possible the continued application of a particular drug to the cornea in individuals who have developed a local sensitivity. The sensitivity is usually manifested by edema and hyperemia of the conjunctiva and palpebral dermatitis while the cornea, during the early stages of the sensitivity, remains unchanged. This may be explained by the difference in tissue pressure of the cornea and the bulbar conjunctiva.

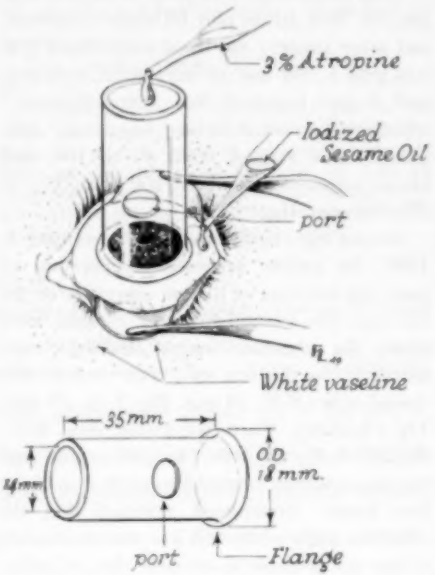

Fig. 1 (Robison). Diagram of device to facilitate the application of drugs to the cornea.

One of the invasive characteristics of most allergens is retention in the interstitial tissue spaces of an excessive amount of tissue fluid. The degree of retention is related among other variables to the tissue pressure which in turn is related to the density, elasticity, and contractility of the tissue.

The tissue pressure of the cornea is greater than the tissue pressure of the bulbar conjunctiva, therefore, from certain stimuli the conjunctiva will become edematous and retain an excess of fluid in its interstitial spaces while the cornea will not.

* From the Houston Eye, Ear, and Throat Hospital and the Department of Otolaryngology, University of Texas School of Medicine.

Use of device

The conjunctiva is anesthetized (three-percent amylcaine has been used). The skin of the lids and surrounding skin is coated well with white vaseline, with particular attention being given to the lashes and canthi. Using gauze to handle the lids the speculum is inserted and opened widely enough to present sufficient area around the cornea to allow the tube to be inserted easily. The head is placed in a position so the eyes may be directed vertically and fixed on a point on the ceiling which will bring the limbus into the horizontal plane.

The operator assumes a comfortable position and grasps the tube between the thumb and index finger so that the port is directed toward the inner canthus. The flange of the tube is placed around the cornea and only sufficient pressure should be made on the eye to insure a tight application. The bulbar conjunctiva is then covered with iodized sesame oil. This oil is used because it adheres closely to the conjunctiva and its specific gravity is such that it will not be displaced readily by aqueous solutions.

Then a few drops of the drug to be used are instilled into the tube so that they come in contact with the cornea. After the drug has been in contact with the cornea for two minutes, a piece of gauze-covered absorbent cotton is placed against the tube just under the port. A few drops of saline are then added to the drug in the tube just to make the drug more visible. Then iodized oil is added to the tube until it displaces the solution of the drug to the level of the port. The surface of the oil is then irrigated with saline and the drug is washed through the port onto the absorbent cotton. The tube is then lifted from the eye and the oil is caught in gauze as it flows away. The excess oil is irrigated out of the conjunctival sac. Temporary blurring of vision may result from oil adhering to the cornea.

The type of flange on the tube used is important. Our tube was cut from a centrifuge tube which had the letter K near the flange and USA below, and was obtained from the Kny-Scherrer Corp., 483 First Avenue, New York 16, New York. This tube is Kimble Brand #45160-15 ml. Another centrifuge tube which probably has given even better results is manufactured by John N. Marquis Co., 52 Walker Street, New York 13, New York, and is their #2490-15 ml. The tube should be selected so that its diameter allows very little of the conjunctiva to show between the flange and the limbus of the particular cornea upon which it is to be used.

The most disconcerting factor for the patient in this procedure is too much pressure on the tube by the operator. This may be regulated better if the operator wears a loupe and gauges the pressure applied on the tube by blanching of the blood vessels under the flange of the tube. The greatest danger from the use of this device is abrasion of the cornea.

This device has been applied daily until sufficient cycloplegia has occurred, then the interval has been 2 or 3 days. Several ophthalmologists have used this device successfully.

1304 Walker Avenue (2).

MOLLUSCUM CONTAGIOSUM GIGANTEUM*

B. C. J. v. d. Meer Maastricht, M.D., and C. E. Gomperts, M.D.
Amsterdam, Holland

Mollusca contagiosa of the eyelids are of rather frequent occurrence. It is well known that these little tumors may be associated with a follicular conjunctivitis, even a superficial keratitis.

Recently, however, we came upon a case of molluscum, entirely different in its clinical appearance and, as far as we could find, not yet mentioned in ophthalmic literature.

* From the Department of Ophthalmology, University of Amsterdam. Prof. Dr. A. Hagedoorn, director.

CASE REPORT

A girl, aged three years, visited the clinic because of a tumor of the inferior eyelid (fig. 1). There was no history of trauma or inflammation and, according to the mother, the growth had steadily increased to its present size in some months.

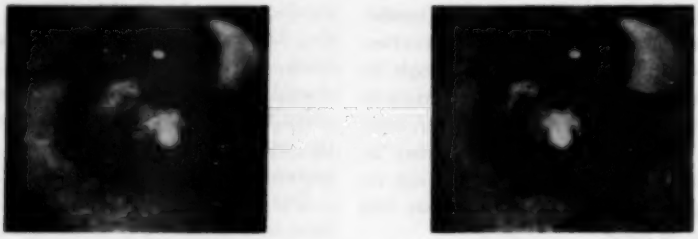

Fig. 1 (v. d. Meer Maastricht and Gomperts). Clinical appearance of tumor.

The tumor occupied practically the whole area of the inferior eyelid, but proved to be completely free from the tarsus. It was covered by normal skin which at the top of the tumor seemed somewhat thinner and had a slightly yellowish tinge. There were some superficial, easily visible ectatic vessels.

Through two perforations at the top, a milky white, fatty liquid appeared which coagulated soon after being expressed. On palpation the tumor appeared to be somewhat more solid than could be expected in an atheromatous cyst and moreover slightly lobulated.

The diagnosis was not clear: as stated an atheromatous cyst could be excluded. It could not be a giant chalazion, since this develops from a meibomian gland. The tumor was free from the tarsus and there was no circumscribed redness of the tarsal conjunctiva. A foreign-body granuloma, a traumatic perforation of an atheromatous cyst with granulomatous reactions of the

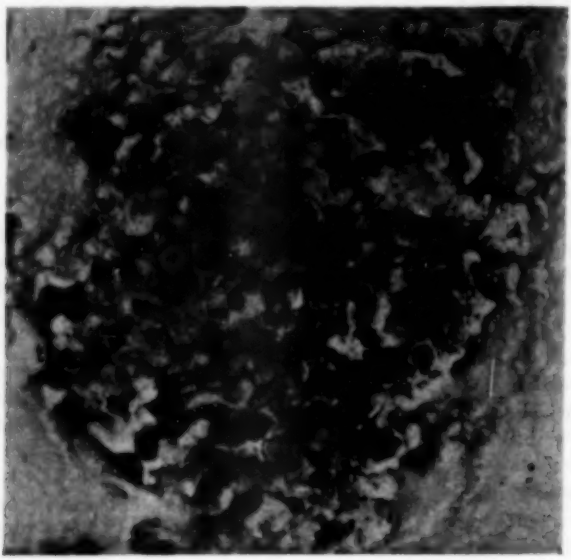

Fig. 2 (v. d. Meer Maastricht and Gomperts). Fluid emerging from the top of tumor, showing molluscum bodies. (×180).

fatty material (lipogranuloma), a rare tumor were discussed.

It was expected that a microscopic examination of the milky fluid emerging from the tumor could be an aid in the diagnosis.

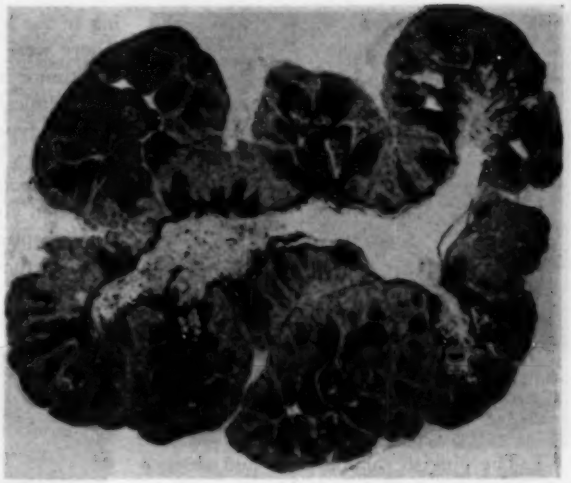

Fig. 3 (v. d. Meer Maastricht and Gomperts). Section through the tumor.

Contrary to what we expected, the Sudan stain was negative, so that it could not contain fat. However, with the Giemsa stain, structureless large bodies and small granules were found which could have given some difficulties in labelling, if, on examination of the patient a number of typical mollusca had not been detected at the root of the nose, the right cheek, on the superior lip, and the right thumb. The bodies and granules were easily recognized as identical with those found in a section of molluscum.

The tumor was excised and the diagnosis confirmed by histologic examination.

Wilhelmina-Gasthuis.

MALIGNANT MELANOMA ARISING IN A DERMAL EPIDERMAL NEVUS OF THE BULBAR CONJUNCTIVA

A CASE REPORT

HERBERT F. KESINGER, M.D.
Sandusky, Ohio

Malignant melanomas of the bulbar conjunctiva arising from benign nevi are of interest because of their infrequent occurrence.

In a review of the voluminous literature up to 1942, Reese[1] found records of only two cases which could be identified definitely as cases of melanoma which arose from a preexisting nevus. He reported one case (a 29-year-old man) in 1947 in which a malignant melanoma of the conjunctiva could be said with certainty to have arisen from a congenital nevus.[1] In five additional cases the melanoma was suspected, from clinical and histologic evidence of having arisen from a nevus.

In 1948, Swan[2] mentioned two cases in which there seemed little doubt that nevi were the source of the malignancy. From the discussion of Swan's paper it would seem that such occurrences had rarely been observed by other clinicians.

It has been pointed out by Reese[1,3] that this infrequent origin of a melanoma from a benign nevus of the conjunctiva is in contrast to the frequent occurrence of malignant change in acquired precancerous melanosis.

The following case is being reported because of several interesting features in addition to the infrequent observation of a malignant melanoma arising from a benign conjunctival nevus. These include:

1. The early age (10 years) at which the malignant changes were observed.

2. The enlargement of the blood vessels supplying the tumor. Such large "feeder" vessels have been emphasized by Samuels[4] and by Swan[2] (in another type of limbal tumor) as being indicative of malignancy.

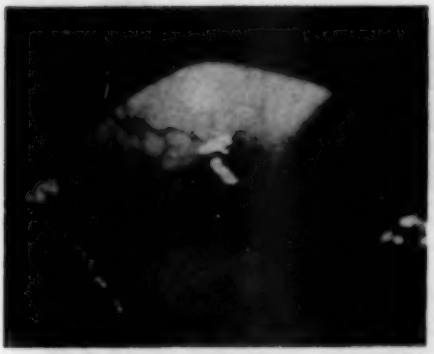

Fig. 1A (Kesinger). Salmon pink episcleral nodule with feeder vessel arising from temporal fornix.

3. The pinkish salmon color and absence of pigmentation clinically which is noted in approximately one third of all conjunctival nevi.[3] Neither the malignant tumor (right eye) nor the benign nevus (left eye) appeared pigmented to clinical observation.

4. The presence of a benign, though potentially malignant nevus, in the bulbar conjunctiva of the other eye.

REPORT OF A CASE

History. C. M., a 10-year-old boy, was brought to the office on September 2, 1948, because of bilateral conjunctival tumors located temporal to the limbi. The tumors were first noted by the parents at the age of 14 months. There had been no symptoms but the lesion on the right eye was thought to have enlarged in recent months. The tumor on the left eye was thought to be the same size as when first noticed. The parents did not know when the tumors had become vascularized.

Examination of the right eye revealed uncorrected vision of 20/20 and no abnormalities except a slightly elevated pinkish yellow tumor 4 by 5 mm. in size in the interpalpebral region temporal to and extending to within 0.5 mm. of the limbus. The tumor moved freely with the conjunctiva. There was a prominent "feeder" blood vessel entering the temporal side of the tumor and arising in the lower temporal fornix (fig. 1A). There were several smaller vessels entering the tumor especially on its temporal side. The clinical diagnosis was: Conjunctival tumor, type undetermined; suspicion of malignancy because of large "feeder" vessel.

Examination of the left eye revealed uncorrected vision of 20/20 and no abnormalities except a similar pinkish yellow slightly elevated tumor 3 by 3 mm. in size lying just temporal to the limbus in the interpalpebral bulbar conjunctiva. This tumor was also freely moveable. There were two less prominent vessels entering its temporal and inferior aspect and originating in the temporal and temporal inferior fornix respectively (fig. 2A).

Pathologic report. The tumor of the right eye was totally excised under general anesthesia on September 6, 1948. The following pathologic report was made by Mrs. H. C. Wilder at the Army Institute of Pathology:

Gross. The specimen is a piece of tissue measuring 4.5 by 9 by 3 mm. The concave brown upper surface is smooth, and has an irregular, deep brown center. The convex base is irregular, from which a dark-brown pedicle extends.

Microscopic. Tumor cells which show

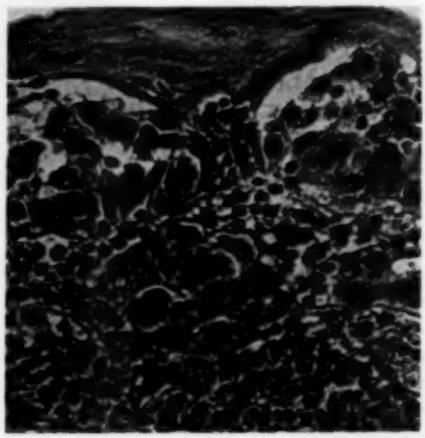

Fig. 1B (Kesinger). Malignant melanoma arising in dermal epidermal nevus.

considerable variation in size and shape are present in and beneath the conjunctival epithelium. Although the nestlike arrangement of nevi is present, the fact that many of the cells have large hyperchromatic nuclei and abundant cytoplasm is indicative of malignant change (fig. 1B). Many multinucleated forms are seen and there is some pigmentation. The tumor appears to have been completely excised but the patient should be carefully watched.

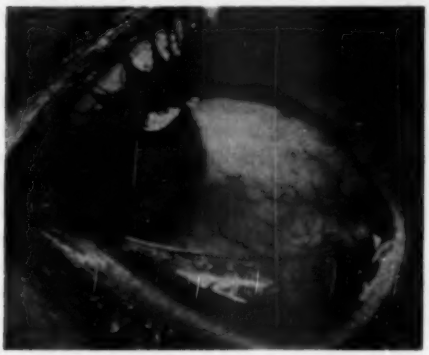

Fig. 2A (Kesinger). Left eye showed a similar nodule without feeder vessel.

Diagnoses. Malignant melanoma arising in a dermal epidermal nevus of the bulbar conjunctiva.

The tumor of the left eye was similarly excised on September 22, 1948, with the following findings being reported by the same pathologist:

Gross. The specimen is a triangular firm pigmented piece of tissue measuring 4.5 by 2 by 1.5 mm.

Microscopic. Nests of cells with somewhat irregular rather homogeneous appearing

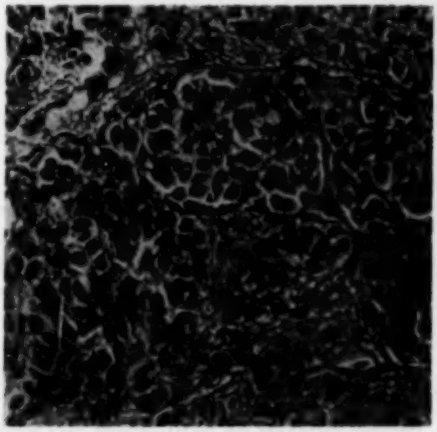

Fig. 2B (Kesinger). Dermal epidermal nevus.

nuclei are present in and beneath the surface epithelium. A few epithelial inclusions are present in the dermis (fig. 2B). On the basis of this second biopsy a diagnosis of nevus would be made although the tumor is dermoepidermal and must be considered potentially malignant. Examination of this tissue does not change our impression of the first biopsy (right eye) which was diagnosed malignant melanoma.

Summary

A case of malignant melanoma arising in a dermal epidermal nevus of the bulbar conjunctiva is reported. This case is unique because of the youth of the patient (10 years), the presence of a benign, though potentially malignant nevus of the other eye, and histologic evidence of the malignant melanoma arising in a congenital nevus, which has been infrequently observed.

134 East Adams Street.

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TOTAL UNILATERAL OPHTHALMOPLEGIA FOLLOWING SPINAL ANESTHESIA

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Eye complications associated with the use of spinal anesthetics have been reported in the literature for the past 50 years. Many reports have been made of ocular paralyses following spinal anesthesia. However, a careful survey of the literature has failed to reveal a single case of total or combined external and internal ophthalmoplegia simultaneously involving the third, fourth, and sixth cranial nerves. Such a case of total ophthalmoplegia was seen at the Michael Reese Hospital following spinal anesthesia and is reported here:

CASE REPORT

History. Mrs. S. G., a 53-year-old white woman, was admitted on the surgical service on February 7, 1949, with a history of gallstones of eight years' duration. Additional history, systemic review, and physical findings were all essentially negative. On February 10, 1949, the patient had a cholecystectomy under spinal anesthesia. Pontocaine (12 mg.) was used. The operation was successful, and no immediate complications occurred.

Approximately 20 hours following the operation, the patient awoke at 4 a.m. complaining of a severe generalized headache and inability to open the right eye. Examination at this time revealed blood pressure to be 174/96 mm. Hg. Complete ptosis of the upper right lid was present. The cornea was clear with corneal reflex present. The right pupil measured approximately 7.0 mm. (the left, 3.0 mm.) and was fixed to light and accommodation; consensual reaction was present. The globe was fixed in the midline and was immobile. Visual acuity was normal, and visual fields were also normal. The patient complained of seeing double only on extreme right lateral gaze.

Neurologic examination showed no generalized muscle weakness. Superficial and deep reflexes were all present and equal, and there was no ataxia or pathologic reflexes. Kahn serology was negative. Spinal tap that morning showed a pressure of 210 mm. H_2O, colorless clear fluid, negative Pandy, and normal cell count. There was a negative history of strabismus in childhood or later.

The patient's vision was: R.E., 20/40; L.E., 20/40; corrected to: R.E., −0.5D. sph. ⌒ +1.25D. cyl. ax. 155° = 20/20; L.E., −1.00D. sph. ⌒ +1.0D. cyl. ax. 20° = 20/25.

The patient continued to complain of intermittent headaches. Sixty hours after onset, she showed slight recession of the ophthalmoplegia in the right eye. With the return of levator function, she was able to open the eye and by the fourth postoperative day, third-nerve function had almost entirely returned. The right pupil became equal in size to that of the left and reacted to light and accommodation. Function of the trochlear nerve improved, and the patient was able to look down with the eye in the adducted position.

Sixth-nerve paralysis continued to persist, and on February 26th, diplopia fields showed double vision of about 45 degrees on looking to the right, up, down, and center. The patient was seen again four weeks after the episode of total paralysis and the abducens paresis was unchanged. On March 23rd, six weeks after onset, the patient showed slight recovery when the right eye could be abducted beyond the midline for the first time. One week later, the patient had an esotropia for far of 30 prism diopters and, for near, 20 prism diopters.

DISCUSSION

In addition to the usual complications of spinal anesthesia such as syncope and hypotension, the nervous system may be involved, though rarely. One complication that occurs, which is of interest to the ophthalmologist, is paralysis of one or more extraocular

muscles. Associated with this finding and usually preceding it, may be headache, backache, vomiting, neuralgia, paresthesias, and blurred vision.

Various writers, reporting cases of ocular palsies following spinal anesthesia, have attempted to draw conclusions from their cases or from cases reviewed along the following major headings: (1) Ocular muscle or muscles affected; (2) interval before onset of paresis after spinal anesthetic; (3) duration of palsy and frequency of recovery; (4) pathogenesis of condition; (5) anesthetic used and dose; (6) frequency of ocular palsy as complication of spinal anesthetic.

Blatt[1] described four cases of paralysis of an extraocular muscle after spinal anesthesia. In reviewing the histories of 84 other cases, he found abducens paralysis in 78 (18 of which were bilateral); oculomotor paralysis with external ophthalmoplegia in six cases (with mydriasis in four and miosis in one); and four cases of trochlear nerve involvement.

All other reports also show that the nerve

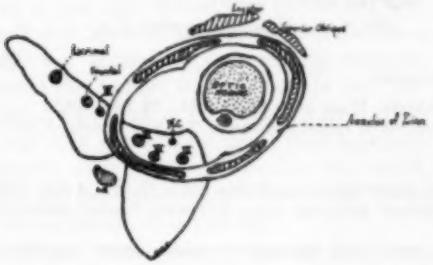

Fig. 1 (Shapira, Schall, and Rodin). Superior orbital fissure. Relationship of nerves entering the orbit. (From Whitnall: *Anatomy of the Orbit.*)

most commonly involved is the abducens.[2, 3, 6, 7] None of the reports stated that all of the nerves, third, fourth, and sixth were affected simultaneously.

The onset of paralysis of an ocular muscle following spinal anesthesia in general was from three days to three weeks after the anesthetic was administered.[2, 4] The paralyses reported in all instances cleared up in from 1 to 12 weeks to as long as 16 months.[2, 4] Reports have even been made of abducens palsy following lumbar puncture without spinal anesthesia.[5]

Almost all of the reports in the literature

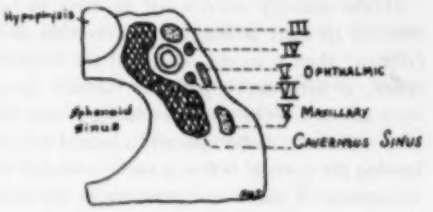

Fig. 2 (Shapira, Schall, and Rodin). Relationship of nerves in cavernous sinus. (From Whitnall: *Anatomy of the Orbit.*)

give possible explanations of the paralysis of an extraocular muscle, but no satisfactory reason has been established for an isolated selective action on the extraocular muscles. Nor is there a reason for the predominance of palsies affecting the external rectus muscles as compared to other muscles.

Various theories have been propounded and are grouped as follows:[6]

1. *Mechanical* causes, as changes in the pressure of the spinal fluid or changes in the blood pressure. Also, the sixth nerve occupies a very superficial position in relation to the fourth ventricle which communicates with the subarachnoid space.

2. *Toxic* causes—direct, local, reflex, or general. A common reason in the early papers was attributed to the type of anesthetic then in use; namely, stovaine, tropocaine, and cocaine—all of which are more toxic than the substances usually used now.

3. *Inflammatory* causes—including the possibility of administrative technique being at fault resulting in a meningismus or localized meningitis.

In the case herein reported, a total ophthalmoplegia was present for about two and one-half days following the onset. A site for the selective action on the three nerves to the

extraocular and intraocular muscles can only be postulated. This would most likely be peripheral, as in the region of the superior orbital fissure. Since no effect of the ophthalmic branches of the fifth nerve were demonstrated, this, too, is hardly probable.

If the sensory nerves are the first to be affected in man as stated by Goodman and Gilman,[8] then it would seem that the corneal reflex, a fifth nerve pathway, should have been affected. (On the other hand, it may be that sufficient motor paralysis could occur leaving the corneal reflex present—similar to sensations of touch and pressure in the skin remaining intact after spinal anesthesia has caused motor paralysis.)

Dr. Frank B. Walsh[14] mentioned two cases of acute bilateral total ophthalmoplegia associated with pituitary tumor with sparing of the fifth cranial nerve. After removal of the tumors, recovery from the ophthalmoplegia was prompt.

The proximity of the cavernous sinus to the affected nerves must be considered for the same reason as the superior orbital fissure syndrome. Although it is stimulating to postulate a mechanism of action, it must finally be admitted that this case of total ophthalmoplegia, even like a single muscle paresis, cannot be explained entirely.

In 1910, Reber[2] reported the occurrence of only five cases of ocular palsy (all abducens) out of 2,000 consecutive spinal anesthesias. More recently, Fairclough,[7] in 1945, reported 10 cases of ocular palsy (all abducens also) in 2,021 patients to whom spinal anesthetics were administered. It would seem apparent, then, that paralyses of all the nerves to the extraocular and intraocular muscles as presented here, are undoubtedly a very rare phenomenon.

Summary

1. A case report is presented of total unilateral ophthalmoplegia following spinal anesthesia for a surgical procedure.

2. Some of the opinions and theories of ocular palsies in the literature are given. The prognosis in all cases is good.

3. No case of paralysis simultaneously involving the third, fourth, and sixth cranial nerves has been reported heretofore. A possible site of paralysis is postulated at the superior orbital fissure.

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SENSITIVITY TO AUREOMYCIN

Report of a case

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Aureomycin is one of the most promising of the evergrowing family of antibiotics. Reports of its effectiveness in certain viral infections,[1] such as epidemic keratoconjunctivitis and herpes simplex corneae, in addition to its apparently high antibacterial action against most ocular pathogens,[2] have brought aureomycin into general use. Since, to date, no cases of ocular sensitivity have been reported and because of the natural tendency to prescribe a new and popular remedy indiscriminately, it was thought worth while to report a case of sensitivity to aureomycin following its local use.

Report of a case

History. F. I., a woman, aged 51 years, was seen in the office on February 1, 1949, because her left eye had become red, the lids swollen, and a lump noticed on the upper left lid several days before. She had treated herself with hot boric-acid packs several times a day but decided to seek medical attention when the "lump" started to drain pus. She had always been in good health except for a skin rash of the face which had appeared shortly after her menopause and for which she had never had medical treatment. There was no history of any allergy.

Ocular examination. Vision in both eyes was 20/50, uncorrected; improved to 20/20 with a small minus correction. The right pupil was larger than the left but both reacted to light and accommodation.

Right eye. Except for the presence of a moderate mucopurulent conjunctivitis, the eye showed no other abnormalities.

Left eye. The upper lid showed an infected meibomian gland which had perforated on the conjunctival surface and through this perforation, pus could be expressed. The palpebral conjunctiva of both lids was markedly congested and swollen. Much mucopurulent material was present. Circumcorneal injection was also evident. The eye findings were otherwise entirely negative.

The skin of the cheeks and the bridge of the nose showed changes typical of acne rosacea.

A smear of the conjunctival pus was taken for bacteriological examination.

Treatment. The palpebral conjunctiva of both eyes was painted with one-percent aqueous silver nitrate solution. Two drops of two-percent aqueous homatropine hydrobromide solution were instilled in the left eye only. A five-percent aqueous solution of sodium propionate[3] was prescribed for home use every four hours in addition to hot compresses.

The patient returned on February 3rd. While there was considerable clinical improvement, it was thought advisable, in view of the severity of the infection as evidenced by the number of staphylococci reported in the smear, to start aureomycin. This medicament (25 mg. of aureomycin hydrochloride mixed with 25 mg. of sodium borate and 62.5 mg. of sodium chloride dissolved in 5.0 cc. of distilled water, freshly prepared) was begun at 6:00 P.M. of the same evening and was continued hourly, two drops being instilled in each eye.

About 24 hours later, the eyelids began to swell. This was associated with an itchy sensation on the top of the scalp, the postauricular area on both sides, and a similar sensation of both forearms.

When the patient was seen the next morning, February 5th, the reaction was more marked in the left eye than in the right. The lower lid of the right eye was swollen moderately and there was localized itching in the middle third of the lid. The upper lid also showed some swelling. The palpebral conjunctiva of the left eye was markedly

congested and swollen; considerable tearing was noted. The acne rosacea appeared to be aggravated, the involved skin being more congested. The aureomycin solution was discontinued and the patient instructed to resume the use of the five-percent aqueous solution of sodium propionate.

The patient returned on February 8th greatly improved. She stated that while the swelling of the lids was subsiding, a transient urticaria of the scalp, back and forearms had appeared. This apparently was another delayed allergic manifestation. The acne rosacea had returned to its original state.

When last seen on February 11th, the patient appeared entirely well. She was still using the sodium propionate.

Comment

Since aureomycin is derived from a mold, streptomyces aureofaciens, it is not surprising that it is capable of producing a sensitivity similar to that of penicillin or streptomycin. Because of this, its indiscriminate use is ill advised. It is well to bear in mind that there are many other drugs, old as well as new, in our ocular therapeutic armamentarium, which are equally efficacious in bacterial infections and are not as likely to cause sensitivities. The newer antibiotics, because of their well-known propensity to cause allergic reactions, should be used only in those cases in which their value has been specifically proven.

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Ophthalmic Miniature

A portion of the newly prepared extract of belladonna, for the sake of experiment, was inserted between, and applied to, the eyelids; in consequence, in the space of about 20 minutes, the pupil was so much dilated, that the iris was almost totally invisible. From the time that the pupil attained to three times its natural dimensions, objects presented to this eye with the other closed were seen as through a cloud; and as it proceeded to the point of extreme dilatation, this effect gradually increased, so that minute and near objects could not be at all distinguished. The pupil approached by almost imperceptible degrees for six days to its natural size; and in proportion as the contraction took place, the sight became more distinct, and the focus nearer the natural.

Robley Dunglison, *Annals of Philosophy*, 1817.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

March 17, 1949

DR. ALFRED COWAN, *chairman pro tem.*

TREATMENT OF GIANT FOLLICULAR LYMPHOMA WITH NITROGEN MUSTARD

DR. BENJAMIN M. CHAMBERS (by invitation) presented a white man, a bricklayer, aged 64 years, who had noticed a swelling in the region of the inner corner of his right eye in May, 1948. Four months later he was admitted to Graduate Hospital.

There was almost complete ptosis of the right upper lid. On palpation, a firm, nontender, nonfluctuant area could be felt along the lateral one half of the upper lid. There was impairment of rotation of the right eye medially and superiorly. There was injection of the palpebral conjunctiva. Vision was: O.D., 6/22; O.S., 6/30. Tension in both eyes was normal.

In the left posterior cervical region of the neck could be felt several slightly enlarged, nontender, movable lymph nodes.

Blood cytology, blood chemistry, and bone-marrow examinations were normal. Blood Wassermann was 4 plus; spinal fluid Wassermann, 4 plus.

X-ray examination of the chest revealed a mass in the midpart of the anterior mediastinum which was thought to be either an aneurysm or a dermoid.

Biopsy of a cervical lymph node was reported as giant follicular lymphoma. Microscopic diagnosis of a piece of tumor from the right upper lid was lymphoma, probably malignant.

The patient was given antiluetic treatment, and 1500 r of X rays over the anterior mediastinum without any visible effects on the mediastinal mass.

Beginning on November 22nd, the patient was given 6.2 mg. of nitrogen mustard for four successive days. Within three days after the completion of nitrogen-mustard therapy, a marked diminution of the swelling in the region of the right orbit was noted. There was simultaneous regression of the cervical lymph nodes. When the patient was examined four months after his release from the hospital, there was no evidence of reappearance of giant follicular lymphoma. There has been no change in the undiagnosed mediastinal mass.

Discussion. Dr. Lawrence H. Beizer: Several points are raised by this case. One is diagnosis, another therapy, and the third prognosis. In this case, an adequate biopsy was essential. Once it was learned that the tumor belonged to the lymphoblastoma group, to which exact division of this group it belonged did not matter much in planning therapy, since it is practically impossible to predict in an individual case what the response will be.

The measures employed in treating the lymphoblastomas are irradiation and the newer chemotherapeutic agents. X rays have been used for the longest period of time. When the lesion is localized, other forms of radiation are often employed; for example, radium or radon. Of the chemotherapeutic agents, radioactive phosphorus and nitrogen mustard have had the longest trial, with urethane, folic-acid antagonists, and the bacterial polysaccharides still in the process of investigation.

Urethane cannot be used very satisfactorily in cases in which the leukocyte count is not elevated, because of its depressing action upon the bone marrow, which may at times be drastic. Aminopterin is the best known of the folic-acid antagonists. Its greatest value has been in the temporary control of acute leukemias in children. It has not

yet had an adequate trial in the lymphomas. The bacterial polysaccharide which has been given a trial in these cases is the one known as P5. It is related to Coley's toxin.

The chemotherapeutic agent which has proven to be most effective in the hands of most investigators is nitrogen mustard. Ordinarily, it has been reserved for those cases in which X-ray therapy has already been used and the patient has become radioresistant. There are occasional instances in which nitrogen mustard is used in preference to X-ray therapy. These are cases where the lymphomatous process is so widespread that it is hardly possible to treat the patient adequately with X rays. The case presented illustrates an instance in which nitrogen mustard was used in preference to X-ray therapy on an important lesion because it was felt that X rays might do avoidable harm.

This is a particularly good example of a satisfactory use of nitrogen mustard. The case is, I think, unique, and it is also important in that it demonstrates that nitrogen mustard is effective in this particular member of the lymphoblastoma group. Previously it was thought that good results were obtained only in Hodgkin's disease. Here you can see a very satisfactory response in a giant follicular lymphoma. It will be of considerable interest to follow the case, and to see how long a remission will be obtained. In the past, it was stated that only short remissions were obtained with nitrogen mustard, but in this case, I think there will probably be quite a long remission.

Dr. Edmund B. Spaeth: It is to be regretted that Dr. DeLong could not be here this evening. He wished to emphasize two or three points of interest and of importance. The first of these was to call attention to the life expectancy of these patients as illustrated by Mallory's series. It is from 6 to 8 years only. Another point in this relationship between lymphoma and Hodgkin's disease is the satisfactory response to radium in the former with a lack of response in the latter. I hope Dr. Beizer will comment on this. In Mallory's series, 25 percent of his cases died of Hodgkin's disease. None of them, however, showed any sign of Hodgkin's disease until late in their course.

Dr. Lawrence H. Beizer: A good deal of interest has centered upon this particular subject. Dr. Custer had a very interesting opportunity during the war to examine all of the tissues coming from patients with diseases of blood-forming organs, and he was able to follow cases in which an original diagnosis of one member of the lymphoma group was made. As a result of studying subsequent biopsies and necropsies, he pointed out, as has been pointed out in the past, that very frequently the original biopsy will be, for example, giant follicular lymphoma and, as time goes on, subsequent biopsies will disclose either lymphosarcoma or Hodgkin's disease, and that, in some instances, the reverse is true. Some of the cases he studied had no treatment, so the change could not be caused by therapy.

Now, as far as the particular point that Dr. Spaeth raised is concerned, most cases of giant follicular lymphoma respond very rapidly and very excellently to X-ray therapy, and have very long remissions. On the other hand, it is only occasionally that a long remission is obtained in a case of Hodgkin's disease, but there are occasional cases on record in which patients have had a remission lasting for many years. This only adds to the confusion, because histologically you cannot see any difference, but clinically, the individual cases may react very differently. This has led some people to group these cases together, to lump them into one group, and to try to discard some of the differentiations based only on histologic appearance. Enough evidence has not yet been accumulated to show there is no difference between the different members of the lymphoma group, and as far as one can tell, you can make an estimate of the prognosis from the histologic picture, but you cannot be very accurate in an individual case.

Dr. I. S. Tassman: I should like to present a case from the medical service of the Mt. Sinai Hospital, which we have had an

opportunity to observe during the past month, which was diagnosed pathologically after biopsy as lymphosarcoma. The case is very similar to the one presented here tonight. It was also treated with nitrogen mustard, and is apparently improved to the present time.

I have a slide to show. The photograph shows the rather marked ptosis on the left side with a marked preauricular adenopathy, and a moderate ptosis on the right side. As I understand it, the effect of the nitrogen mustard is to depress the bone marrow, and bring about improvement, perhaps temporary, in that way in these cases. This was a metastatic involvement of the orbits particularly on the left side with a rather marked infiltration into the lids which could be felt and distinguished very easily on palpation.

I believe also that nitrogen mustard has been employed in some of the lid diseases of a leukemic nature, and some of the other blood dyscrasias. As far as I have been able to ascertain, I think the improvement that has been obtained in these cases has been a remission, and temporary. The final prognosis, however, is very unfavorable.

Goniotomy and the treatment of congenital glaucoma

Dr. Harold G. Scheie reported the results obtained from goniotomy in the treatment of 16 eyes with congenital glaucoma, two of which were associated with nevus flammeus. The tension was normalized in 11 eyes and good visual function was retained. The tension was not controlled in three eyes, but the disease was far advanced and the eyes were blind or practically blind before goniotomy.

Failure also occurred in both eyes of a child who had bilateral congenital glaucoma associated with nevus flammeus of the face and eyelids. This may represent a condition in which goniotomy is contraindicated as suggested by the preoperative gonioscopic picture of anomalous vessel formation on the iris and ciliary body. All of the patients have been followed postoperatively for two years or longer. Although the number of eyes is small, the observations are in accord with those of Barkan.

Discussion. Dr. P. Robb McDonald: Through the courtesy of Dr. Shipman, I was able to do seven goniotomies on his service at the Wills Hospital last year. The results were not quite as good as Dr. Scheie's.

Seven operations were performed on four eyes. The first patient operated on had had two previous filtering operations on each eye. In one eye, the disease was well advanced and two goniotomies did not control the tension. The other eye has remained free of photophobia and the patient apparently sees quite well. Another patient was operated on nine months ago and has done quite well. The last patient to be operated on developed a massive hyphemia, but it gradually subsided and the tension is down, although it is too early to be certain of the result.

I should like to ask Dr. Scheie why he used atropine postoperatively; and, if hemorrhage follows operation, does he ever use a miotic instead of a mydriatic?

Dr. Edmund B. Spaeth: Dr. Scheie's results are beautiful. I wonder, however, why he does not use the contact lens. We have used it regularly, and not operated any cases without the contact lens. Cordes called our attention to a nice point in the use of the contact lens so that reoperations could be done, and at the same time have a fresh area in the angle for incision. This is to rotate the eye slightly nasalward or temporalward with two fixation forceps. During the first goniotomy, the vertical meridian is to lie, shall we say, nasalward, and with the second temporalward, so that three fourths of the angle is available for surgery.

Of the cases that we have done at the Graduate Hospital, no patient was operated who had had surgery prior to the goniotomy. Our failures also were failures with diathermy, with fistulizing operations, and with cyclodialysis. Of all the cases operated prior to goniotomy, only two cases still have vision. One of them, that of a young lady, aged 20 years, still has one eye with 6/12 vision, a

recovery from four operations. The other case was also that of a young lady. She had had three operations on the right eye and four on the left (cyclodialysis). She is now a senior in high school and still has 6/30 vision. It is wonderful that she can have this period for education; but the final result in her case is still very much in doubt.

Dr. Warren S. Reese: I should like to ask Dr. Scheie why he could not introduce the air through the goniotomy wound.

Dr. William Zentmayer: I thought, because of the rather favorable results reported here tonight, it might be of interest to mention the hopeless attitude that the profession took to this condition some 30 or 50 years ago. I am not sure which it was, but I sent out a questionnaire to members of the profession and got some 25 replies, and only one doctor had any suggestion to make for the treatment of this condition; that was Dr. John E. Weeks who suggested that possibly the new operation of corneal trephining might be of use in these cases. I remember the reply that one of the most skillful surgeons we have had in ophthalmology, the late Webster Fox, made that treatment for congenital glaucoma was enucleation of the eye.

Dr. I. S. Tassman: I think that Dr. Scheie should be congratulated for this presentation, especially since it is an important and necessary advance in the treatment of infantile glaucoma.

We probably do not have the answers to this problem yet. I should like to recall three cases which I have had under observation for a period of six years. All cases, six eyes, came to my attention when the patients were aged one year; in one instance, perhaps, at the age of 10 months. They were shown here about four years ago. All six eyes were operated—one eye in each case with an Elliot trephining operation and the opposite eye with modified Lagrange operation. All three patients have been under observation up to the present time. They are about seven years of age. The eye in which the Lagrange operation was done was lost in each case, but enough vision is present in the other eye to enable the patient to go about without assistance, although all three, I believe, are in blind schools. The intraocular pressure in the better eye remained stationary.

Dr. Harold G. Scheie: I wish to thank all of the discussors for the interest they have shown in this paper.

Dr. McDonald asked why atropine is used postoperatively. It has been our practice to use atropine only if the eyes show rather marked ciliary injection during their postoperative course. Once the chamber is formed, there seems little danger of promoting peripheral anterior synechia by its use, because the angles are usually wide open in this type of glaucoma. Management of anterior-chamber hemorrhage has offered no serious problems in this group of patients. It has been our practice to treat traumatic hyphemia by rest and cold compresses. We ordinarily use neither miotics nor mydriatics, although at times there might be indications for either type of therapy, as was brought out in Rychener's excellent paper on the treatment of traumatic hyphemia given before the Section on Ophthalmology of the American Medical Association in 1943.

Dr. Spaeth has asked why we do not use a contact lens. It is cumbersome, makes the operation much more difficult, and in our hands seems to offer no advantage. Furthermore, the corneas in these patients are somewhat hazy and visualization of the angle is difficult.

Dr. Reese inquired as to our reasons for not injecting air through the goniotomy puncture. The difficulty is that the air will not stay in because the incision cannot be made sufficiently oblique to act as a valve. We therefore use the method described by Chandler in which he makes a very oblique puncture through the cornea with a knife needle. A fine hypodermic needle is then inserted into the tract, but not into the anterior chamber, and air is injected. The inner lips of the incision act as a valve preventing the escape of air. The small goniotomy puncture automatically closes as the air enters the chamber.

ENUCLEATIONS AND IMPLANTS

DR. JAMES S. SHIPMAN AND DR. PATRICK J. KENNEDY reported on 55 eyes which had been enucleated or eviscerated—trauma, 19; sarcoma, 16; glioma, 2; other ocular pathologic conditions, 18. Of the traumatic group, only one patient wore glasses.

There were 10 simple enucleations, 18 buried implants, and 17 exposed implants. All of the buried implants are still in place. Of the 17 exposed implants, three were lost in patients, aged 4, 10, and 16 years, respectively.

The exposed implants have the following advantages over the buried type: (a) better motility, (b) less depression of the upper lid with less narrowing of the palpebral fissure. On the other hand: (a) the surgical procedure is more difficult, (b) the exposed implant is more apt to be extruded, and (c) the cost is greater.

Discussion. Dr. James S. Shipman: I think that Dr. Kennedy is to be congratulated on this very excellent presentation. He has been most generous to include me as co-author. Indeed, I have had nothing to do with this fine piece of work except to consent to Dr. Kennedy's doing these new implants on a number of patients on our service at the Wills Hospital. As a matter of fact, I have been rather critical and cynical of the whole affair.

I have been using the Dimitry or Frost Lang type of implant, which is completely buried, for so long that it has been difficult for me to see how a partially buried implant would stay in. We have always felt that when the implant became visible it was a sure sign that the implant, whether gold, plastic, or glass, was coming out. If the implant was bone, it meant that it would become irritable and have to be removed and this often proved to be a major procedure.

These newer types of implants are only partially buried with a considerable portion of the anterior surface exposed, and for this reason I have felt that the implant would not stay in. In this type of implant it would appear that one is subjecting the scleral cup and Tenon's capsule to infection. However, something which we cannot explain seems to take place that does not occur in the older type of buried implant which becomes partially exposed.

I have become quite interested in this newer procedure as described by Dr. Kennedy, and I have been convinced that we should at least give it a trial. I have done one case by the transscleral route in which the implant, a Cutler universal, was inserted in the scleral cup with the muscles still attached. I chose this type because it more closely approaches the Dimitry type of implant. Dr. Kennedy assisted me in doing this operation, and the whole procedure was very simple, and no complications were encountered. The hemorrhage was controlled by first clamping the optic nerve with a hemostat before cutting it. The patient's postoperative recovery was uneventful except for slightly more than usual reaction according to Dr. Kennedy. About two weeks after the patient was discharged from the hospital the implant came out through the opening in the front of the scleral cup. This was one of the cases mentioned by Dr. Kennedy.

Notwithstanding this unfortunate experience with my first case, I feel that this type of implant, namely the intrascleral, is the most logical and, when the last word is said on partially buried implants, this type or one similar to it, with the implant in the scleral cup to which the recti muscles are still attached, will be the one of choice. I certainly intend to try more of this type of implant and am grateful to Dr. Kennedy for encouraging and stimulating me in this work.

I feel that too many simple enucleations and disfigured sockets with poorly fitting prostheses are due to the fact that the surgeon was not industrious enough nor thoughtful enough at least to try some type of implant. I think we owe it to our patient to give him the best looking prosthesis possible, and we should all give these newer procedures a chance. If they fail, we have done no harm, and the socket is no worse than if they had not been tried.

Dr. P. Robb McDonald: In 1886, Frost first reported the implantation of a foreign substance into Tenon's capsule. From then until this decade modifications of the enucleation and evisceration procedures have consisted essentially of changes in the various implant materials. With the advent of World War II and the shortage of suitable glass prostheses, attention was directed to the use of plastic material. I think that all ophthalmologists owe a debt of gratitude to Dr. Ruedemann and Dr. Cutler who were the pioneers in developing the integrated implants.

Dr. Kennedy has discussed the advantages and disadvantages of the semiburied implants. The operative procedure is not difficult and, in an uncomplicated case, takes little if any more time than the classic Dimitry operation. The results in my opinion are unequivocal and, as the movies have shown, it is very difficult at times to tell which eye has been enucleated. In every case that I have operated on the patient considers his prosthesis cosmetically more acceptable than his previous blind eye. In two of my patients the enucleation had been performed 10 and 15 years previously. An exposed bone ball was removed from the sclera in one and a gold ball from the floor of the orbit in the other. The placing of an integrated implant as a secondary operation is time consuming, but the results are worth the effort.

One of the criticisms of this procedure is the exposure of a foreign body in the orbit. Surgically this would appear unsound. However, I have not as yet seen any cases of secondary infection. In fact, it is amazing how little reaction occurs once the initial postoperative period is over. I have one patient whose prosthesis is removed only once every 2 or 3 weeks. At this time, it is washed with soap and water and replaced.

There is one interesting feature about some of these patients. Prior to operation, the blind eye is frequently exotropic and convergence if accomplished is very poor. Following operation, however, these patients frequently converge quite well.

I would like to thank Dr. Shipman and Dr. Kennedy for the privilege of discussing their paper.

Captain Settembrin: Since May, 1948, the Eye Department at Valley Forge General Hospital performed 24 enucleations. In 22 of these 24, the Cutler type universal motility implant was used. Three types of operations have been done; eviscero-enucleation in 17 cases; enucleation with insertion of the Cutler implant in Tenon's space in four cases. In one case we did a reimplantation in an orbit in which an implant had not been previously placed, and the simple enucleation had been done about one year prior to the patient's arrival at Valley Forge General Hospital.

We have been able to observe each of these 22 patients with Cutler implants for four weeks or more, and we have had only one complication; and that was in a case in which the implant extruded after a period of seven months. The patient was hospitalized during that period for administrative reasons. He received a blow to the orbit, developed cellulitis, and the implant was extruded gradually. We finally had to excise it.

Dr. Norman Cutler: I have known about Dr. Kennedy's work. I obtained one of his implants through Dr. McDonald, and it has been very interesting to hear his report.

I think that there is probably one additional characteristic of an ideal implant that Dr. Kennedy might add to his list of four, and that is permanence. I think that the question of permanence has not been answered yet, and probably will not be for some time.

I was very glad to hear Dr. Shipman speak out in favor of using some of the types of implants that have been worked on lately, despite his unfortunate experience. I think that even if these implants eventually turn out to be unsuccessful, they may lead to something that is better than anything we have had, and at least during that interval the patient is quite happy with the result.

In connection with the extrusion through the corneal opening, I agree with Dr. McDonald that I thought it could not happen. I do know of 2 or 3 other cases in which it has happened. Just why I do not know, apparently the sclera stretches. I believe it will be possible to replace the implant at the time of extrusion. The reason I say this is because within the last couple of months I have had a patient who had been hit with a golf ball a month or so previously, severely lacerating the sclera. The eye had then started to shrink, and I did an evisceration type of procedure. The laceration extended pretty well across the cornea, and through the sclera for about 10 mm. through the external rectus muscle. In order to get out all of the scar tissue, I had to open the scleral collar completely, and remove some of it, and then resuture it. When the patient went home, the implant looked just as well as any other.

In addition to that, a doctor, about a year ago, put in an implant by eviscerating the contents of the globe, then making an incision from front to back, putting in an implant and suturing it. It is still in place, and quite satisfactory. In the cases in which the implant has extruded there has been no proliferation of scleral tissue. There has been proliferation of tissue from the anterior scleral collar. In regard to the sutures, the scleral type implant can be put in without any sutures at all.

I have put the ball and mesh implant in as an enucleation procedure, with only four catgut sutures through the muscles and through Tenon's and conjunctiva.

I feel that Ruedemann is really the person who deserves all the credit for attracting our attention to the possibilities of putting in an incompletely buried implant.

My feeling about the movement is that the most movement is obtained from the evisceration type of procedure and the next from the enucleation procedure.

Dr. Joseph Waldman: What would happen to patients with partially imbedded implants if they should get an acute purulent conjunctivitis? I do not mean immediately postoperatively, but at a later date. What assurance can we give the patient that there is no danger aside from extrusion of the implant, should an acute infection occur?

Dr. John Findley: I should like to ask Dr. Kennedy how many cases of chronic low-grade conjunctivitis he sees with this prosthesis. It seems to me that the irritation caused by this prosthesis might be considerably more severe than that caused by the ordinary type of prosthesis.

Dr. Patrick J. Kennedy: I should like to thank Dr. Settembrin, Dr. Cutler, and others who discussed this paper. We do not feel that conjunctivitis is any more of a hazard with an exposed implant than with a buried implant. The acute conjunctivitis responds very well to penicillin or sodium sulfacetamide. The chronic conjunctivitis is taken care of by frequent irrigations of metaphen (1:10,000) or other mild antiseptic solutions. The socket with an exposed implant needs no special care. It should be irrigated at least twice a day with water and the prosthesis cleaned with soap and water. Some patients are allergic to plastics. These will have more reaction, and an increased amount of mucoid discharge will necessitate frequent cleaning of the socket. We are still hoping to find a nonallergenic plastic material.

Meningitis following panophthalmitis is still mentioned in our textbooks, but is so rare that very few in this gathering have ever seen it. Meningitis as a result of infection through a socket is a rare possibility. The advent of the exposed implant should not increase the hazard of meningitis since the implant is surrounded posteriorly by viable tissue possessed of the same immune properties that other bodily tissues have. It is possible that a retro-implant abscess might occur, but again it seems most unlikely. Time will tell if these conditions are to be feared.

M. Luther Kauffman,
Clerk.

COLORADO OPHTHALMOLOGICAL SOCIETY

January 15, 1949

DR. RALPH DANIELSON, *presiding*

CLINICAL CASES

JUVENILE GLAUCOMA

DR. PAIGE (by invitation) presented Miss S., aged 17 years, who was seen in July, 1947, for a refraction. Vision corrected with a −2.5D. sph. was 20/20, O.U. Gross fields and tactile tension were normal at that time. On December 24, 1948, she returned complaining of headaches. The vision was corrected to: R.E., 20/30; L.E., 20/25+. The tension was: R.E., 15 mm. Hg (McLean); L.E., 35 mm. Hg. The right field was restricted. Pilocarpine (one percent) was given but caused severe headache and nausea. Eserine every four hours decreased the tension to R.E., 38 mm. Hg; L.E., 33 mm. Hg, but it returned to: R.E., 60 mm. Hg; L.E., 35 to 40 mm. Hg and has remained about that ever since.

Discussion. Dr. Long noted that the right iris is atrophic and there is pigment on the corneal endothelium, suggestive of a Krükenberg's spindle. It is possible that the pigment is the etiologic factor in this glaucoma.

Dr. Danielson mentioned that it is unusual to have a patient less comfortable with pilocarpine than with eserine. He thought that, since medical treatment had not controlled the tension, surgery should be done. Dr. Crisp said that nitrate of pilocarpine is less irritating and could be used up to four percent. Dr. Stine suggested that the newer drugs, mecholyl and carbamide, be tried. He thought a goniotomy should be done as there is a deep anterior chamber and pigment in the trabeculas. Dr. Nelson considers a trephination the best surgical treatment. He had a patient, a child, aged five years, with cupping of the disc in one eye and later in the second eye. A trephination was done in each and the tension has remained normal.

KERATITIS OF UNKNOWN ETIOLOGY

DR. GARRISON presented Mr. G. C., aged 19 years, a college student. He was first seen November 22, 1948, at which time the left eye had been irritable and inflamed for three days. On August 1, 1948, following a severe sore throat he had an ulcer of the left cornea which subsided in about 20 days. Penicillin did not improve it, but argyrol seemed to help. Several opacities remained reducing his vision from 20/20 to 20/40 in this eye. Two more episodes of mild irritation in the left eye occurred before he was seen in November.

His past medical history was negative. Family history was negative except that a paternal uncle had had recurrent corneal ulcers from the age of eight years to 40 years. They stopped after taking a series of "cold tablets."

The left eye had considerable photophobia and lacrimation and slight conjunctival injection. The left pupil was equal to the right and reacted normally. There were about 15 small opacities over the pupillary area from pinpoint to 0.5 mm. in diameter with some vascularization of the corneal epithelium at the extreme lower pole and some staining in the area. The opacities extended through all layers of the cornea but were most prominent in the stroma. Tuberculin test was normal, as was the sedimentation rate.

Discussion. Dr. Strong said he finds that dionin often helps clear such lesions before they have developed so far. Dr. Kaplan suggested antistine can be used effectively with dionin.

Dr. Stine said that, when he saw the case, three conditions occurred to him—a tuberculous process, an allergic condition, or a disciform keratitis. He suggested an allergic survey, a course of tuberculin if the skin test were even faintly positive, and Pregl's solution twice a week in the conjunctival sac. Since the keratitis occurred after a sore throat, the patient might be allergic to the bacteria of the common cold.

Dr. Oaks (guest) uses Pregl's solution

subconjunctivally, 0.5 cc. once a week. Because of the vascularization he would give riboflavin in heavy doses. Dr. Crisp said that sometimes one gets remarkable benefit from physiotherapy—baths of physiologic salt solution for 3 to 4 minutes at a time.

Pigment at the Limbus

Dr. Harry Shankel presented L. S., a girl, aged nine years, with pigmented area in the conjunctiva to the temporal side of the right cornea. This was first noticed one year ago. The mother thought it had become larger during this year. It had increased in size since October when first seen by Dr. Shankel. There was no other pathologic finding in the eye.

Discussion. Dr. Oaks (guest) said that a pigmented tumor should be removed if it increases in size. During puberty increased endocrine gland activity is apt to stimulate growth of such lesions. Dr. Edna Reynolds said that the increased vascularity in this case makes it dangerous since it almost always means a malignancy. She has seen a 33-year-old patient with a less malignant looking lesion which ended in generalized sarcomatosis.

Dr. Kaplan read in the *British Journal of Ophthalmology* of the use of radon seeds in malignant pigmented lesions in children. Dr. Drogemueller has tried the melanin test in melanoma of the choroid but got no reaction until there were extensive metastases. Dr. Strong had used the melanin test in a patient in whom a diagnosis between choroidal hemorrhage and melanoma was doubtful. It was of no help. Dr. Stine had removed by excision a similar pigmented area from a young boy, aged five years. There has been no recurrence. He advises that a pigmented area should be removed as soon as possible.

Suspected Glaucoma

Dr. Strong presented Miss F. M., aged 36 years, who, three years ago, had noticed flashes of light while in a dark room. Two months ago these recurred. There have been no headaches, pain in the eyes, or rainbows around lights. In September, after taking streptomycin for a bladder infection, she had some tinnitus and loss of hearing. In 1937, she had had an appendectomy and left salpingo-oophorectomy. In 1932 and 1947, she had a tumor of the right breast excised. A Kahn test was negative and spinal fluid normal. X-ray films of the skull showed no pathologic condition. The vision with correction was 20/20 in each eye. The fundi were normal. The tactile tension was minus one. The right visual field showed a typical superior nasal step; the left a Seidel scotoma.

Conclusion: The visual field at first indicated a superior temporal quadrant defect indicating chiasmal damage. The last two fields, taken one month apart had identical field defects, quite typical of glaucoma. A recent pressor test caused a rise in tension from 18 to 37 mm. Hg. Aside from this the tension has not been found to be above normal.

Discussion. Dr. Oaks suggested that the tension be taken for a 24-hour cycle, using the caffein provocative test at the end. Dr. Schwigert had watched this patient for a number of years. She has been apprehensive and imaginative. He found scotomas above the fixation point. There was a shelving of the lower border of the right disc, and slight shelving of the left disc. He did not find the tension elevated. He believes that the pressor test may give false positives and is therefore not very reliable.

Vitreous Hemorrhage

Dr. Filmer presented Mrs. V. H. She first noticed blurred left vision following a severe respiratory infection. The vision at that time was: R.E., 20/20; L.E., 2/400. The vitreous had many fine opacities with a dense cloud inferiorly. A few keratic precipitates were present and there were cells in the aqueous. General medical examination was negative except for a positive tuberculin patch test.

Typhoid was given intravenously. By December, 1946, the vitreous had cleared and

vision in the left eye had improved to 20/50. On January 2, 1947, vision in the left eye again became worse and a fresh choroiditis with deep hemorrhages was noted. On January 30, 1947, she saw spots before the right eye. Scattered fine vitreous opacities in the anterior vitreous were seen. No pathologic process could be found on fundus examination. The vitreous of the left eye had cleared by April, 1947, but a hole in the macula reduced vision to 20/200—.

In April, 1948, vision in the right eye was 20/25 with fine anterior vitreous opacities still present. Many small new vessels were seen around the disc. The left vitreous was relatively clear. The hole in the macula was present and there was a healed choroiditis inferiorly.

Vision in the left eye suddenly became very blurred on October 26, 1948, when the patient had a cold; the vitreous in this eye was black except in the upper temporal portion. Vitreous opacities were present in the right eye and there were more new vessels than were seen six months previously. A course of X-ray therapy has been given for a month and the vitreous hemorrhage of the left eye has cleared.

Discussion. Dr. Crisp considers general care more important than tuberculin or X-ray therapy. Bed rest, if possible and, if not, plenty of sleep at night and rest during the day. Sharp changes of temperature should be avoided. Sleep should not be cut short for several nights in succession. In many of the vitreous hemorrhages which occur when the patient is tired or has a cold, an infantile tuberculosis has created an allergic basis for the condition.

Dr. Long suggested that an allergy other than to tuberculosis, possibly respiratory organisms, might be responsible for the lesions since they appeared when the patient had a cold. In this case a respiratory vaccine might be given.

Dr. Fillmer said that the patient, when young, had lived with her aunt who had tuberculosis, but an internist had examined her thoroughly and found no tuberculosis. He had thought of an endocrine origin for her trouble as she is overweight. She has reduced 30 pounds.

Scientific meeting

Protective devices against diplopia of squint

Dr. L. Weston Oaks, Provo, Utah, (by invitation) read a paper on this subject, a summary of which follows:

An effort is made to reëmphasize distinguishing characteristics of the three more important protective devices against diplopia that appear to have existed at some time in the course of all squints.

It is pointed out that: (1) The three are closely related in their mode of development, as well as in the nature of their mechanisms; (2) one or both of two factors, (a) age of onset of diplopia, and (b) degree of inherent desire for binocular function, may operate to determine which device will be adopted.

All three are functional in nature, and even amblyopia ex anopsia with very low visual acuity shows no structural alterations in the macular elements.

Careful diagnosis of amblyopia ex anopsia is of great importance, and there is no good excuse for mistaking some other condition for this to the extent of setting up continuous occlusion on a mistaken assumption.

A simple explanation of the mechanism providing for development of suppression, anomalous retinal correspondence (anomalous sensorial relationship), and amblyopia ex anopsia, based upon the physiology of nerve tissues, is briefly suggested.

A plea is made for active treatment of amblyopia ex anopsia, in preference to passive continuous occlusion of the better eye. It is believed to be more satisfactory, both as regards ultimate results and as a means of arriving at them with the least possible damage to the individual's daily living program.

Katharine H. Chapman,
Recorder.

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NINTH CLINICAL MEETING OF THE WILMER RESIDENTS ASSOCIATION

The Residents Association is composed of former senior residents of the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital. At the moment they number 24 eminent practicing and teaching ophthalmologists. Four of the more recent graduates are heads of departments of ophthalmology in universities in various parts of the country.

Their annual meeting affords an opportunity for them to review their own work for the past year and that of the present staff, attending and resident, of the Wilmer Institute. They graciously invite a number of ophthalmologists from other cities to attend these meetings. Each year the meetings have become more popular.

This year, from April 19th through 21st, about 225 guests were registered and the hall was filled almost to the end of it for the three days of the meeting. The reason for the popularity becomes at once apparent with a glance at the program.

This year 28 excellent papers were presented. Some of these will appear in subsequent issues of the JOURNAL. The first morning was occupied by the subject of ocular hypersensitivity, the afternoon by a symposium on the "Use of ACTH and cortisone in ophthalmology." It began with a splendid review of the present state of our knowledge of these substances by the professor of medicine, Johns Hopkins University, Dr. A. McGehee Harvey, and was followed by papers on the experimental and clinical results of the use of these compounds by Alan C. Woods and John M. McLean. Then a delightful talking film of the late eminent professor, W. H. Welch, was shown. An excellent film of "Goniotomy for congenital glaucoma," by A. E. Maumenee, completed the day's program.

On the second day were presented an interesting paper by Howard A. Naquin on the "Argyll Robertson pupil following herpes zoster ophthalmicus"; a report by M. Elliott Randolph of his experimental studies of transplanting the cornea of syphilitic rabbits to a normal recipient. The results were negative for transmission of the disease by this method. L. H. Pierce described the efficiency of systemic and subconjunctival penicillin in the treatment of syphilitic interstitial keratitis in 33 cases. W. F. Hughes, Jr., and R. T. Snip each reported his results with integrated implants following enucleation. S. D. McPherson, Jr., described the excellent results obtained in treatment of various external ocular allergies with hystadyl.

In the afternoon three papers of ophthalmo-neurologic interest were given: F. B. Walsh on "Studies of hemorrhages in the optic-nerve sheaths"; T. O. Coston on the "Ocular effects of stellate ganglion block"; and A. L. MacLean on the "Ocular indications and effects of thoracolumbar sympathectomy." W. C. Owens and Ella U. Owens reviewed the subject of retrolental fibroplasia and pointed out the lower incidence of the condition when premature infants were fed supplementary vitamin E.

One of the best papers was that of Bernard Becker and L. T. Post, Jr., on "Thrombosis of the central retinal vein." The authors showed that micro-aneurysms, hitherto believed only to occur in diabetes, are found in the retina in the area of thrombosis or occlusion of retinal veins from other causes. They confirmed this finding by experimentally producing, most ingeniously, an occlusion of the central vein in the cat's eye and finding the micro-aneurysms in histologic preparations several months afterward.

The third and last day consisted of papers of clinical and physiologic interest, for example "The threshold gradients of rods and cones and their relation to receptor density," by Louise L. Sloan; "Yellow-blue color blindness," by N. R. Davis and M. L. Beidler; and a magnificent demonstration of a new method to study retinal physiology by the electrical stimulation of a single element, by Kuffler, Hunt, and Talbot.

Charles E. Iliff showed a film and gave a discussion of a simplified dacryocystorhinostomy in which he used a Striker saw and an implanted Gill catheter. This method shortens the time of operation enormously and without damage to the nasal mucous membrane.

The afternoon was given over to discussions of corneal transplantation by R. T. Paton and by R. T. Snip, and a discussion of choline esters by G. R. Koelle. It terminated with a clinical pathologic conference by Jonas S. Friedenwald, W. K. Livingston, and L. H. Pierce. The audience was most attentive and absorbed. No discussion was permitted but questions were fired to the essayists and, at times, things became lively, with an interchange of opinions back and forth.

There was considerable social activity and the famous Baltimore hospitality was evident on all sides. The experience was a profitable and happy spring interlude that deserves the popularity it has.

Derrick Vail.

THE VARIETY CLUB BLIND BABIES FOUNDATION

The Variety Club is an organization which draws its membership largely from the moving picture and entertainment industry. The nomenclature used in the club is based on that employed in the old circus organization, so that its chapters in various cities are known as "Tents"; its members as "Barkers"; its president as "Chief Barker" and the Board of Trustees as "Canvas-men." In September, 1949, the San Francisco Tent organized the Variety Club Blind Babies Foundation to provide home training for preschool blind children and their parents. The initial finances were raised by public subscription but the future operating costs have been perpetually underwritten by the Variety Club.

The foundation is composed of a board of directors chosen from the membership of the Variety Club. An advisory committee made up of the professors of ophthalmology of the two medical schools of San Francisco, the head of the state institution for the blind, and representatives of some of the state agencies interested in the welfare of the child, outline the policies to be followed.

At the present time three qualified instructors, selected by the superintendent of the blind school, are rendering this service and are visiting 45 homes in northern and central California.

Training procedures necessarily vary. In general, however, they can be divided into three categories: the infant, the preschool child, and the parent. If the child is an infant less than six months of age, the work centers around the orientation of the parent, with emphasis on what to expect from the child. If the parents have not resolved the traumatic period of adjustment, every effort is made to be of assistance. The parents are encouraged to attend the class at the San Francisco State College given for parents of the visually handicapped child, where they are taught to know what to expect in the way of development of their blind children. Parental attitudes range from rejection of the child to extreme over-protection so that the instructor must start "where the parent is" and progress from there.

Work in special orientation is required in cases of children past the infant stage. In some cases it will be necessary to teach them, with the coöperation of the parent, how to feed and dress themselves—even to walk and care for their most elemental wants. They are taught to play and the parents are advised as to the toys to select. Above all, every effort is made to prevent the development of "blindisms."

The cases are referred to the foundation by the pediatrician or the ophthalmologist, after they have discussed the foundation with the parents. Case records are filled in by the ophthalmologist, and the instructor then visits the parents to discuss the program with them. If they approve, the instruction is started. It often requires tact and diplomacy to win the parents over to the program. Once the program is started the worker visits the home once or twice a week to work with the mother in the progress of the training.

In addition to the problem of the blind child, there may be family problems that are further complicated by the blind child. If there are expenses connected with the case that the family cannot meet, the instructors work with the existing public and private agencies set up for that service.

The blind child of school age is provided for by the state schools for the blind. It is the newborn blind child and especially the parents of these babies that, in the past, have been neglected.

To parents of newborn or recently blinded babies the outlook toward the future is dark indeed. Especially to young parents with their first baby, the discovery that the eagerly-awaited infant is blind is a great mental shock. It changes their carefully laid plans for the future and causes untold heartache. These parents need the kind, sympathetic understanding of someone who is willing

and able to discuss the situation with them; show them the bright side and give the practical aid that is needed in the care and development of the child during the preschool years.

This the Variety Club Blind Babies Foundation of San Francisco is accomplishing and the members are to be congratulated on their splendid work in taking care of a heretofore badly neglected and important part of the program for the care of the blind child.

Frederick C. Cordes.

CORRESPONDENCE

THE O'CONNOR "CINCH SHORTENING"

Editor,
American Journal of Ophthalmology:

The flood of books and articles on the extraocular muscles continues. This is admirable except that most of them are rehashes of classical writings with the terminology changed, which merely makes the subject more confusing.

The O'Connor "cinch shortening" operation, combined with a Stevens-type subcapsular tenotomy, which Dr. O'Connor uses, continues to give excellent results up and down the Pacific Coast and at a few other isolated points. Its obvious value in the tropias and particularly the phorias is, however, ignored by most of those who write on the subject. The procedure is seldom mentioned except to be condemned by authors who have not seen it done properly and who do not understand it.

The highly useful and original method of shortening an extraocular muscle, introduced by Dr. Roderic Patrick O'Connor in 1912 and now widely used on the Pacific Coast, is not receiving the attention it deserves. In my opinion, those who have not seen Dr. O'Connor's procedure, and particularly his results, are missing something very important. He is the dean of those who are interested in this particular field, and future generations of ophthalmologists will recognize this debt to him if most of the present generation does not.

(Signed) Joseph G. Smith,
San Francisco, California.

BOOK REVIEWS

MODERN PRACTICE IN OPHTHALMOLOGY. Edited by H. B. Stallard. New York and London, Paul B. Hoeber, Inc., 1949. Clothbound, 525 pages, 231 illustrations, 30 color plates. Price, $12.50.

As stated in the preface, Mr. Stallard has compiled this book "to give the general practitioner an outline of the modern practice of ophthalmology." It is written with the idea that the general practitioner will use it as a reference text in connection with any cases that he may have in common with an ophthalmologist.

The contributors to the book are among the most distinguished ophthalmologists of England and a fine volume has been produced. Twenty-one chapters cover most of ophthalmology's important subjects. One of the features is the colored plates of which there are 30. Black and white illustrations are numerous and good.

The first chapter is logically devoted to gross and microscopic anatomy and the second to pathology, each covering about 30 pages. Medical ophthalmology, which is particularly pertinent, is well handled in 56 pages. Following medical ophthalmology and the methods of examination is a short chapter on ocular therapeutics. Then follow 130 pages on diseases of the various ocular organs. A special chapter is devoted to glaucoma as certainly should be done in any text written for general practitioners. Refractive errors and strabismus require almost 100 pages. Diseases of the orbit and tropical ophthalmology have a small section each. The book concludes with a rather specific, but abbreviated, description of the common eye operations by Mr. Stallard. These are not intended as a text for the ophthalmic sur-

geon but, as enunciated in the preface, are in only sufficient detail to give a good understanding to the general practitioner as to what is planned and what may have been done surgically for his patient.

The book should serve well the purpose for which it is written. One questions how many clinicians have enough close associations with ophthalmologists to desire to study a text of this sort. Putting one's self in the place of the internist, unless he has an affiliation with ophthalmologists, he would be no more inclined to purchase such a book as this than he would to purchase books on every other specialty written for a similar purpose.

Lawrence T. Post.

La Histioterapia en Oftalmologia (Histiotherapy in ophthalmology). By J. Ormaechea and J. M. Talayero. Barcelona, Spain, Berna, 1949. 103 pages.

This important monograph is published by the well-known Instituto Barraquer in Barcelona. It is interesting since it deals with the subject of therapy by heterogenous tissues of which Filatov and other Russian ophthalmologists have recently spoken so highly. The authors start be defining the subject and state that the tissues included in the patient's body work by producing some chemical substances which Filatov has called "biogenic stimulants." According to Filatov, these stimulants are elaborated in the depth of the tissues, animal or vegetable, living in unfavorable physiologic conditions which, however, are not bad enough to kill them.

The tissues used by Filatov and other Russian ophthalmologists were of animal and vegetable origin. The former class included homogenous, autogenous, and heterogenous inclusions from cadavers of animals, or, in exceptional cases, from living human donors. In the vegetable class, Filatov used aloes, barley oil, and others.

The method was applied to many general diseases but, in the field of ophthalmology, the tissues used were the membranes of the eye, skin, brain matter, peritoneum, placenta, blood, tumors, and so forth. These tissues were given parenterally, orally, or in topical applications, including them under the patient's conjunctival membrane.

Ormaechea and Talayero applied Filatov's method in a great number of cases—581 in all. This has allowed them to reach definite conclusions regarding its value. They used mostly the tissue of the placenta, specially prepared for this experimental work in the institute. Of the 581 cases, 93 were of corneal diseases; 60, iridocyclitis; 40, choroiditis; 110, retinitis pigmentosa; 239, myopic degenerations; 63, detachment of the retina; 9, postneuritic atrophies of the optic nerve; 14, glaucoma; 2, sympathetic ophthalmia; 2, chorioretinitis; 1, an eye injury.

The Spanish authors come to the conclusion that the merits of the method have been greatly exaggerated, but they do not consider it a complete failure. They believe that histiotherapy has some effect in retinitis pigmentosa in which they had 88 improvements in the 110 cases treated. The method was entirely without results in choroiditis, iridocyclitis, and old leukomas. They found that inclusion was beneficial in keratitis of tubercular, syphilitic, scrofulous, and herpetic origin.

The book opens with a chapter on the history of the method and ends with a complete bibliography, mostly of French and Italian authors, in addition to the Russians.

Manuel Uribe Troncoso.

Grundriss der Augenheilkunde. By F. Schieck. (11th edition revised by E. Engelking.) Berlin-Göttingen-Heidelberg, Springer-Verlag, 1949. 248 pages, 203 illustrations, some in color, index. Price, not listed.

A favorite with German medical students for three decades, the 11th edition of this well-known compendium has been revised by Engelking since Schieck's death. It is not intended as a substitute for more com-

prehensive textbooks but rather as a supplement to clinical lectures. Only essential facts are presented. Theoretic discussions are held to a minimum, and are primarily to serve definite didactic purposes. The selection and reproduction of illustrations can hardly be surpassed. With admirable restraint, the reviser has refrained from projecting his own personality into this new edition but yet has succeeded in incorporating some phases of our specialty heretofore neglected without changing the original character of the volume.

In the chapter dealing with color and light sense, everything essential to the medical student is adequately covered in a few sentences. The presentation of anomalies of refraction has been enlarged without including details exclusively of interest to the ophthalmologist. Diseases of the external eye and its adnexa are treated more minutely, and a number of excellent illustrations—actual photographs as well as drawings—are added. No attempt has been made, however, to bridge the gap between the older and this new edition regarding changed concepts of treatment. Also, the presentation of the morbid processes of the uveal tract, neglected by Schieck in his original publication, is still inadequate.

For a book of this scope, surgical principles are covered with amazing adequacy, and are brought up to date throughout. It is surprising that the free tenotomy is still advocated instead of the recession universally practiced in this country.

Engelking has succeeded admirably in bringing this familiar and popular little compendium more in line with present-day ideas, and it is to be expected that his labors will win for it many friends in its new form.

Stefan Van Wien.

THE 1949 YEARBOOK OF THE EYE, EAR, NOSE AND THROAT. Edited by Derrick Vail, M.D., D.Oph.(Oxon.), and Samuel J. Crowe, M.D. Chicago, The Year Book Publishers, 1950. 580 pages, cloth binding, 124 illustrations; subject and author index. Price, not listed.

The editorial responsibility for the Eye Section of the *Year Book*, which for many years was so worthily undertaken by the late Louis Bothman, will henceforth be assumed by Derrick Vail, a most fortunate selection, as he is by training and temperament supremely qualified for the task. Dr. Vail's personal touch is shown in the selection of significant articles for consideration and even more in his numerous brief but sententious annotations.

Somewhat over half the volume is devoted exclusively to ophthalmology—291 pages, 67 illustrations. The articles considered are reviewed rather than abstracted and ample illustrations clarify the details of surgical technique—as exemplified in Sugar's operation for pterygium or Benedict's approach to orbital tumors. The number of articles of ophthalmic interest published in the general literature is surprising—references to at least 15 such journals were noted.

On the jacket are challenging questions which most of us would have difficulty in answering without reference to the text. Though this dramatizes the useful information in its contents, even more profitable is the broad perspective of the volume and its handy reference format.

James E. Lebensohn.

CURRENT THERAPY 1950. (Latest approved methods of treatment for the practicing physician.) Editor, Howard F. Conu. Thirteen associate editors. Philadelphia, W. B. Saunders Co. 736 pages, index. Price, $10.00.

The success of the 1949 volume and the development of several new therapeutic methods and agents necessitated the publication of this edition. More than 250 authoritative contributors describe the treatment they use in infectious diseases, diseases of the respiratory system, cardiovascular sys-

tem, diseases of the blood and spleen, digestive system, disorders of metabolism and nutrition, of the endocrine system, urogenital tract, the venereal diseases, diseases of the skin, of the nervous system, locomotor system, obstetric and gynecologic conditions, and diseases due to physical and chemical agents.

Those familiar with the 1949 issue will realize the importance to the busy practitioner of such a reference work in the field of therapeutics. But the book is useful in many ways to the ophthalmologist who, after all, is a doctor of medicine, too; for example, the chapter on headache and its treatment.

Derrick Vail.

Bulletins et Memoires de la Société Française d'Ophtalmologie. 1948, v. 61, pp. 1-496.

The symposium on keratoplasty conducted by L. Paufique, G. P. Sourdille, and G. Offret is not printed in this volume but is issued separately, as is customary. However, the detailed discussions of the symposium are published in full.

The indications for partial penetrating keratoplasty, the possibilities of the surgical replacement of the whole cornea, and the advantages and disadvantages of keratectomy as compared with lamellar keratoplasty are critically reviewed.

The discussions contain several original ideas concerning the biology of the transplant. Amsler emphasizes the importance of the chemical exploration of the aqueous and explains how such studies may indicate the best time for keratoplasty. The pathologic transformation of the transplant, its cause, and its possible prevention are also thoroughly discussed.

In addition to the keratoplasty discussions, 56 scientific papers are presented. Covering a wide variety of ophthalmic subjects, they are excellent presentations and interpretations of the clinical, pathologic, and physicochemical observations of the investigators.

Alice R. Deutsch.

Transactions of the Ophthalmological Society of Paris (and of the Ophthalmological Societies of the East, of Lyon, and of the West). November, 1948, pp. 698-724.

This small volume contains the report on the annual convention of the French Ophthalmological Society which was held at Paris on November 21, 1948.

M. Amsler, who gave a pictorial demonstration on the microscopic findings of the aqueous in inflammation, emphasized the clinical importance of diagnostic puncture of the anterior chamber and microscopic and ultramicroscopic examination of its content. The procedure makes the incompleteness of information given by the slitlamp quite apparent. About 40 slides were projected and accompanied by concise and exact commentary. A motion picture showed the Brownian movements of the protein and lipoid particles, the formation of fibrin, the crystallization of cholesterin, leukocytes, and their ameboid movements, and the phagocytosis of streptococci. These and many other interesting phenomena served to emphasize the value of a study of a few drops of aqueous.

Mme. Suzanne Braun-Vallons presented a paper on heterophoria which, together with its discussion, reviewed all the important phases of the physiology and pathogenesis of this condition and gave a well-balanced account of the modern trends in its diagnosis and treatment.

Alice R. Deutsch.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Pagliarani, N. **Pathologic findings in an eye of a newborn with icterus gravis due to isoimmunization by the Rh factor.** Boll. d'ocul. **28**:625-632, Oct., 1949.

The eye tissues of the infant who died as a victim of the Rh factor incompatibility showed marked hyperplasia of the mesenchymal elements and of the endothelial cells; a dissociation of the pigmentary epithelium was found. (6 photomicrographs, references.)

K. W. Ascher.

v. Wolffersdorff, H. **Allergy and tuberculosis of the eye.** Klin. Monatsbl. f. Augenh. **115**:655-664, 1949.

Chronic recurrent uveitis is of tuberculo-allergic origin in 70 percent of the cases according to the greatest number of German authors. A positive intracutaneous tuberculin reaction indicates that there is present somewhere in the body a focus of tuberculous infection and the body has formed antibodies. The focus usually lies in the lymph nodes and the lymphocytosis at the height of the tuberculin reaction is the result of an inflammatory process in the lymphatic system. An evaluation of the white-cell count in connection with the tuberculin reaction allows one to estimate the state of tissue resistance. In case of dysergy, or tuberculin hypersensitiveness, we find a sudden increase in neutrophile leucocytes with increase in juvenile and neutrophiles, and an increase in eosinophiles. Tuberculin therapy is in these cases contraindicated. Suitable for tuberculin therapy are cases in which the neutrophiles remain normal, or the neutrophiles fall and the lymphocytes increase. R. Grunfeld.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Amsler, M., and Verrey, F. **Myosis and mydriasis by chemical mediators.** Ann. d'ocul. **182**:936-937, Dec., 1949.

Both the sympathetic and parasympathetic mechanisms of the eye are discussed with special reference to pupillary movements. The local action of acetyl-

choline is illustrated by the myosis which follows its injection into the anterior chamber after enucleation. Solutions of adrenalin and acetylcholine instilled at the same time produce neither pupillary dilatation nor contraction; one apparently neutralizes the other. The injection of a small amount of acetylcholine into the anterior chamber after cataract extraction tends to produce a round pupil. If prolonged myosis is desired, the use of acetylcholine-increasing drugs such as pilocarpine should be supplemented by cholinase-inhibiting drugs such as eserine.

Chas. A. Bahn.

Büning, Karl. **Experiences with mintacol.** Klin. Monatsbl. f. Augenh. **115**:534-538, 1949.

Mintacol, diethoxyphosphoracid-p-nitrophenolester, is a strong miotic. It increases accommodation and counteracts the effect of atropine on the pupil in a 1 to 7,000 solution. In 1 to 10,000 solution, its value is comparable to 2-percent pilocarpine and ¼-percent eserine solutions. It has the same pharmacologic action and indications as has pilocarpine and eserine.

R. Grunfeld.

Cima, V. **Experimental retinosis pigmentosa from iodate intoxication.** Boll. d'ocul. **28**:614-620, Oct., 1949.

Doses equivalent to 1/10 gram per kilogram animal of $NaIO_3$ were injected intravenously, to compare the action of sodium and potassium iodide with that of the periodate. The rabbits were treated for four days and, ophthalmoscopically, sodium iodide seemed to be more poisonous than potassium iodide, which produced retinal changes somewhat later. Sodium iodate, however, produced no retinal degeneration. Four eyes of each group were subjected to microanalysis and an average of 14 gamma of metallic iodine per gram was found in the eyes of animals treated with sodium iodide, 6 gamma after potassium iodide, and no iodine after periodate. Administration of the bromides of sodium and of potassium did not produce fundus changes. In order to exclude the influence of illumination, in two treated animals one eye was occluded by tarsorraphy previous to, and 10 days after, the administration of the iodine salt; no difference between the open and the occluded eye could be detected. Other animals received, four days previous to the iodine intoxication, and for 20 subsequent days, 3 cc. of vitamin E daily (corresponding to 0.27 gram of alpha-tocopherol daily for 24 days); no protective action of this treatment could be ascertained, whether the vitamin was administered in watery or in oily solution. Slight differences in the severity of the experimental retinosis do occur and might have misled previous investigators to believe in a protective action of alpha-tocopherol. (References.)

K. W. Ascher

Lepri, Giuseppe. **A study of the activity in vitro of paraminosalicylic acid on organisms which cause ocular infections.** Arch. di ottal. **52**:310-325, Nov.-Dec., 1948.

Because of the effectiveness of paraminosalicylic acid on the tubercle bacillus in vitro, the author tested its effect on other organisms. A certain efficacy was shown on all the tested organisms, although much less than that which was noted with the tubercle bacillus. Simultaneously investigations were carried out on the effect of combining the acid with antibiotics or sulphones. The addition of antibiotics decreased the total inhibitory action, that of sulphones increased it.

Francis P. Guida.

Lepri, Giuseppe. **The absorption of streptomycin and the period of its persistence in the aqueous after subconjunc-**

tival injection. Arch. di Ottal. **52**:297-309, Nov.-Dec., 1948.

Fifty thousand units of streptomycin were injected subconjunctivally in rabbits. The inhibiting action on bacteria of this aqueous in vitro was used as an index of the rate of passage of the drug into the anterior chamber and the length of time that the drug remained. Streptomycin is diffused in the same manner as penicillin, but much more slowy. An injection every eight hours maintained a therapeutic level. Vasoconstrictors slightly prolonged the maintenance of the drug in the aqueous, while the use of vasodilators hastened its diffusion. Streptomycin was also found in the aqueous of the other eye, much later, and in much smaller quantities. Francis P. Guida.

Niedermeier, Siegfried. **The significance of lactoflavin in the retina.** Klin. Monatsbl. f. Augenh. **115**:556, 1949.

The deterioration of vision in chronic simple glaucoma may not be due so much to the increased pressure upon the nerve head as to vascular and consequent nutritional disturbances. In a woman with chronic simple glaucoma the author injected 120 mgm. of lactoflavin slowly intravenously. Her vision improved from the recognition of hand movement before the eye to counting fingers at 2 m. distance. The improvement lasted for 48 hours only. Two weeks later the experiment was repeated with a similar result. The tension of 55 mm. Hg was not affected by the injection. G. Grunfeld.

De Vincentiis, M., and Auricchio, G. **The metabolism of the amino acids in the ocular tissues.** Rassegna ital. d'ottal. **18**: 373-383, Nov.-Dec., 1949.

The authors studied experimentally the effects of light and dark upon the metabolism of the amino acids, particularly in the retina and also present the results obtained by other investigators. They were able to show that exposure to light resulted in a decrease of the amino acids in the retina and an increase in the content of ammonia. They attempted to determine whether the retinal process of enzymatic diaminization of the amino acids could furnish energy for the visual function. The results, both in vitro and in vivo, demonstrated that light has no appreciable influence upon the biologic destruction of such substance. Eugene M. Blake.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Belmonte Gonzalez, Jose. **A color blind family.** Arch. Soc. oftal. hispano-am. **9**: 1276-1280, Dec., 1949.

A genealogical tree of three generations with a number of red-green blind is reported. In one of the branches of the last generation the father, four sons and three daughters were color blind. One daughter had normal color vision. The mechanism of transmission of color blindness is discussed. In the dicussion of this report Del Rio Cabanas reported a rare case of a color blind woman, whose father had normal color vision. (4 graphs.) Ray K. Daily.

Belmonte Gonzalez, Manuel. **Observations on astigmatism at non-perpendicular axes.** Arch. Soc. oftal. hispano-am. **9**:1281-1284, Dec., 1949.

The author suggests that "astigmatism at non-perpendicular axes" be substituted for Marquez "bioblique astigmatism." A review of 1,183 refractions disclosed 3.6 percent of cases with astigmatism in which obliquity of the axes of greatest and least refraction to each other was greater than 5°. The patients were tested by the biastigmatic method of Marqutz, and by the usual method of using spherocylinders. It is concluded that for practical purposes the biastigmatic method of

Marquez results in the most accurate correction. The ophthalmometric astigmatism approximates the final astigmatism only if it is high, and the usual method of spherocylindric testing arrives at an accurate correction only in cases of low astigmatism. Ray K. Daily.

Carreras Matas, Marcelo. **The adjustment of lenses in the trial frame.** Arch. Soc. oftal. hispano-am. **9**:1231-1232, Nov., 1949.

The errors in refraction data caused by faulty alignment of the lenses in the trial frame are discussed, and a corrective manipulation suggested. (2 figures.)
Ray K. Daily.

5

DIAGNOSIS AND THERAPY

Belmonte Gonzalez, Nicolas. **Additional illumination for the Maggiore perimeter.** Arch. Soc. oftal. hispano-am. **9**:1269-1275, Dec., 1949.

Belmonte added an illuminating device in front of the projection mirror of the Maggiore perimeter, which gives uniform illumination to the arc. This provides a constant contrast between the target and the arc of the perimeter, and the examination may be performed in a dark room without having the patient become dark adapted in the course of the examination. (4 figures.) Ray K. Daily.

Fedrizzi, Giuseppe. **Surgical therapy in supraorbital neuralgia.** Riv. oto-neuro-oftal. **24**:461-470, Nov.-Dec., 1949.

The medical treatment which gives temporary relief in acute forms does not prevent relapses. Avulsion of the nerve at the level of the supra-orbital foramen gave lasting relief to 40 patients.
Melchior Lombardo.

Gandolfi, C., and Morpurgo, F. **The treatment of ocular tuberculosis with para-amino-salicylic acid.** Rassegna ital. d'ottal. **18**:384-389, Nov.-Dec., 1949.

Three cases of tuberculous iridocyclitis and two of chorioretinitis were treated with para-amino-salicylic acid or its sodium salt. In a patient who was receiving it for generalized tuberculosis a chorioretinitis of the Jensen type developed, but healed promptly with good functional result. In the other four cases moderately satisfactory results followed the treatment. Further study, and the possible advantage of employing streptomycin in conjunction with para-amino-salicylic acid is suggested.
Eugene M. Blake.

Gross, Gerhard. **Penicillin treatment in ophthalmology.** Klin. Monatsbl. f. Augenh. **115**:592-602, 1949.

Intramuscular injection of penicillin is effective in intraocular diseases of the eye and makes subconjunctival injections, a difficult procedure in office practice, unnecessary. Clinical observation proves that penicillin is able to penetrate the blood-aqueous barrier in inflamed eyes.
R. Grunfeld.

Heinsius, Ernst. **Penicillin in intraocular infections.** Klin. Monatsbl. f. Augenh. **115**:587-592, 1949.

The author clarifies the indications for penicillin therapy in different infectious eye diseases and compares its value with other antibiotics. R. Grunfeld.

Holstege, K. H. **Penicillin salves in ophthalmology.** Klin. Monatsbl. f. Augenh. **115**:602-605, 1949.

Penicillin salve is a valuable agent in the treatment of external diseases of the eye, and when it is combined with a sulfonamide its range of indication extends to almost all infectious diseases of the external eye. Pilocarpine and atropine can be incorporated in the penicillin-sulfona-

mide salves and thus the range of usefulness extended further. R. Grunfeld.

Lugossy, Gy. **How shall sulfonamide and penicillin be administered in ophthalmology?** Klin. Monatsbl. f. Augenh. **115**: 618-624, 1949.

The author enumerates various infectious diseases of the eyelid, orbit and globe in which penicillin should be given either by local application, by subconjunctival or intramuscular route, together with sulfonamides by oral administration. He warns against giving sulfonamide for more than three days for it has a cumulative effect. Penicillin, however, may be given for two additional days after a clinical cure has been noted in order to prevent a remission. R. Grunfeld.

de Saint-Martin, R. **How to conduct tissue therapy.** Ann. d'ocul. **183**:16-57, Jan., 1950.

The improvement which has been reported to follow tissue therapy in the treatment of pigmentary retinal degeneration varies from none to 80 percent. Similar variations exist in the treatment of numerous other eye diseases. In addition to the author's rather wide experience in tissue therapy, an analysis of approximately 1,000 patients treated by others is presented. He attempts to explain the many inconsistencies in the literature on this highly controversial subject which is of great current interest especially in Europe.

Tissue therapy is based on the concept that some foreign substances, injected or implanted into the body, contain or produce chemicals or enzymes called biogenetic stimulants. These are essentially products of disintegration. Especially those from organs such as the placenta and thymus are believed to contain hormonal substances which retard presenile degenerations in all parts of the body. Little is apparently known concerning the chemical composition of the active principles of tissue therapy and still less about their action. Some think they act only as organic foreign bodies which produce only varying local reactions. Sterols, which are disintegrated at about 60 degrees C. are supposed to be an important factor in some biogenetic stimulants, but sterilization does not change their activity. The many methods of preparation which have been used, including injections and/or implants from fresh organs or those conserved in ice and autoclaved, apparently do not affect the medicinal value of the therapeutic agents. The use of numerous substances ranging from aloes to ovaries is reported. Subcutaneous, subconjunctival or retrobulbar injections as well as subcutaneous or subconjunctival implants are employed. Most frequently used are placenta and cod liver oil. Treatments with cod liver oil or placenta extracts are given weekly or biweekly for more than three months. Subconjunctival implants require replacement every two weeks. The treatment is apparently not affected by age nor sex, and the same good and bad results are reported with many different types of treatment in the same disease.

Tissue therapy has been employed in practically all types of ocular disease. Its greatest value is apparently in delaying the course of progressive degenerative diseases involving the corneosclera, uveal tract and retina. In the treatment of both the active and residual stages of inflammatory diseases the same almost magical cures and dismal failures are reported as in degenerative diseases. Most frequently mentioned in this contribution are pigmentary retinal degenerations, severe myopias, retinal detachments of different forms and primary optic atrophies.

Among the reasons for the wide variations in the results resported are 1. the selection of cases; 2. the correctness of the diagnosis; 3. the influence on the mental reactions of the patients of the enthusi-

asm or pessimism of the author. The nationality or political outlook of the author, and even the possibility of profit through the exploitation of a new remedy of potential interest must not be lost sight of. The improvement which has been observed by practically all authors has been functional and not structural. Generally speaking, it has been very slight and apparently transient.

The author is to be congratulated in presenting the largest series of patients yet treated with this highly controversial method. It is difficult to correctly evaluate the indications and merits of a method the fundamentals of which are not yet understood. The author believes that its wider use would justify an unprejudiced study.

Chas. A. Bahn.

Thiel, R. **Conteben (TB1/698) in tuberculous eye diseases.** Klin. Monatsbl. f. Augenh. **115**:624-654, 1949.

The author discusses the effect that oral administration of conteben, thiosemicarbazone, has on tuberculous infections of the eye. Conteben weakens the vitality of the infecting organism and improves the histiogenic resistance of the body. It leads ultimately to the strangulation of caseated tubercles by the formation of circular connective tissue bands and by proliferation of reticular and collagen fibers until the tuberculous focus is entirely encircled. The optimum dose is 0.05 gm. twice or three times a day. One should be hesitant to increase the dose for the rapid breakdown of the tubercle bacilli. The necrotic tissue may cause untoward reactions and complications like reactivation, Herxheimer reaction, hemorrhages, hepatitis, and other toxic symptoms. The treatment should not be interrupted before a total cure has been achieved, otherwise one may cultivate a drug resistant bacillus. The main significance of conteben therapy lies in the healing of the extra-ocular foci which eliminates the cause of recurrent attacks and allergic reactions. The course of treatment differed in various individuals. In one group the disease improved gradually without the manifestation of acute inflammatory symptoms, in another group, usually after 4 to 6 weeks of treatment or after increasing the dose of conteben, rhythmic inflammatory processes with recessions set in, with exudates in the anterior chamber, deposits on Descemet's membrane, and formation of foci near old ones. The author is of the opinion that these focal reactions, as in tuberculin therapy, are a necessary attribute of conteben therapy.

G. Grunfeld.

6

OCULAR MOTILITY

Guibor, George. **Nonparalytic strabismus: problems in treating infants and children with crossed eyes.** Med. Cl. North America pp. 283-302, Jan., 1950.

Fixation is not well developed until an infant is about four or five months of age. Vision is about 20/2,000 at 4 months, 20/1,000 at 6 months, 20/200 at 9 months, 20/150 at 1 year, 20/45 at 2 years, 20/30 at 3 years, and 20/20 at 5 years. A monocular crossed eye results in a decreased visual acuity, loss of binocular stereopsis, and after a while loss of movement of the eye. Conjugate deviations, spastic esotropia, and strabismus sometimes exist in infancy and often at birth, whereas accommodative esotropia appears later, about the second or third year. The pediatrician can help to discover abnormalities by watching all of his small patients as regards their ability to fix a light monocularly, and their ability to follow a light. A history of strabismus in the parents gives a 50 percent chance of strabismus in the offspring. A table is presented showing the main differences between physiologic deviations and strabismus. A crossed eye is frequently associated with head

tilting, and this condition is sometimes mistaken for a congenital torticollis. This is commonly due to paralysis of the superior oblique muscle. Guibor divides the stages of the development of strabismus into the following: 1. potential, in which the vision, projection, and muscles are usually not abnormal, 2. periodic, in which the eye deviates more frequently, especially when the child is tired, sleepy, or angry, 3. fixed habit, in which one eye deviates most of the time and can be treated surgically, and 4. stage of degeneration, when amblyopia is present, apparent palsies of the muscles are developed, anomalous correspondence is found, and suppression of the crossed eye is severe and constant. The patient becomes essentially a monocular individual. Later the deviated eye becomes partially immoveable and contractures develop.

In the early stages the author likes the use of atropine in the non-deviating eye, and orthoptic training for those five years of age or older who possess deviation of 15° or more. Sometimes prisms are used and he prefers waiting until the patient is eight years old before doing surgery. (2 tables, 8 figures, references.)

Bennett W. Muir.

Lijó Pavía, J., and Piantoni, G. **Strabismus. Operation and reëducation.** Rev. otoneuro-oftal. **24**:87-92, Sept.-Oct., 1949.

In studying a case of strabismus the authors follow this procedure: antecedent investigation, perimetric determination of the degree of deviation, visual acuity, manifest and cycloplegic refraction, and a fusion study. Eight cases are reported which were corrected by surgery and subsequent orthoptic training. (2 figures, references.) Edward Saskin.

Zarrabi. **The operation of strabismus.** Arch. d'opht. **9**:732-736, 1949.

The author describes the disadvantages and dangers of the standard resection and recession operations in which accidental perforation of the sclera has led to complications, including sympathetic ophthalmia and other forms of uveitis. He proposes an operation requiring no penetration of the sclera and in which the effect can be readjusted postoperatively. The operation consists essentially in the following steps. 1. The insertions of the internal and external recti are exposed. 2. A cotton suture is passed through the skin of the lid just above the outer angle, then beneath the bulbar conjunctiva to the upper border of the external rectus tendon which is seized in two bites, close to the insertion. The needle is then passed subconjunctivally, close to the limbus above, as far as the upper border of the internal rectus tendon through which it is then passed to emerge at the lower border. It is then passed subconjunctivally below the limbus to the lower border of the external rectus tendon through which it is passed in a single bite. The needle is then introduced subconjunctivally to emerge through the skin of the outer angle just below the original point of entrance. 3. The two tendons are then cut, the externus at its insertion but the internus behind the sutures. 4. The suture is then tightened, the externus tendon being advanced until the eyes appear straight. The two ends of the suture are then tied over glass beads. 5. At the first dressing 48 hours later the suture is readjusted if necessary to obtain the best correction. The suture is removed on about the tenth day. The operative procedure is reversed in cases of divergent strabismus.

P. Thygeson.

7
CONJUNCTIVA, CORNEA, SCLERA

Arques Girones, Emilio. **Spring catarrh in an annular progressive form described by Pascheff.** Arch. Soc. oftal. hispano-am. **9**:1228-1230, Nov., 1949.

The author reports a case of spring

limbal catarrh, which after some years of the usual course developed a corneal involvement similar to that described by Pascheff under the name of annular progressive and concentric form of spring catarrh. It was a type of corneal pannus, beginning at the limbus above, and occupying the upper third of the cornea, with sharply circumscribed borders. It formed a semi-transparent veil, denser toward the limbus, with a finely granulated surface, and microscopic elevations similar to those seen in edema of the epithelium; in addition there were numerous fine, irregularly striate subepithelial opacities; the vascularization was not as massive as that of trachomatous pannus. Corneal sensitivity was but slightly reduced, and fluorescein revealed no epithelial loss. (2 figures.) Ray K. Daily.

Borsello, Giuseppe. **Alteration of corneal curvature following tenotomy of medial rectus.** Rassegna ital. d'ottal. **18**: 390-395, Nov.-Dec., 1949.

Borsello measured the corneal curvature of 22 eyes for which tenotomy of the medial rectus was later performed. Measurements were made with the Javal-Schiøtz or Zeiss ophthalmometer. Postoperative measurements were made at the end of one month and several eyes were measured again at 10 to 12 months. In 19 eyes a definite change of refraction was evident. There was a change in the astigmatism varying from 1.3D to 1.5D. The alteration in curvature was chiefly an increase of refraction in the vertical meridian and a decrease in the horizontal.

Eugene M. Blake.

Brognoli, Carlo. **Essential degeneration of the conjunctiva.** Arch. di ottal. **52**:326-362, Nov.-Dec., 1948.

Two cases of a pemphigous-like conjunctival degeneration are described. There was obliteration of the fornices by symblepharon and marked corneal degeneration. Neither patient had cutaneous pemphigous.

Two theories of essential degeneration are usually advanced, one that it is a manifestation of a pemphigous, and the other that various etiologic agents are responsible. Brognoli favors the latter view. Only when there is an associated cutaneous lesion can the pemphigous origin be accepted. Francis P. Guida.

Cortes de los Reyes, Hernan. **Treatment of trachoma.** Arch. Soc. oftal. hispano-am. **9**:1067-1085, Oct., 1949.

The literature on the classical treatment of trachoma, mechanically and with silver and copper salts, is briefly reviewed, and that on sulfa drugs and penicillin covered more thoroughly. The author's personal investigations concerned a new preparation put out in two concentrations by J. R. Geigy, S.A., under the names of G.P. 952 and 953. Conjunctival instillations three times daily were not constant in their effect. They led to amelioration of the subjective symptoms without any significant effect on the follicles in several cases, and remained ineffective in others. In one patient five weekly subconjunctival injections resulted in smooth conjunctivas and relief from subjective symptoms; in the second the injections were discontinued because of ineffectiveness. Tried in experimental herpes in rabbits, this medicament was without effect.

Ray K. Daily.

Costi, C. **Allergic conjunctivitis due to a septic focus in the nose.** Arch. Soc. oftal. hispano-am. **9**:1293-1303, Dec., 1949.

For relief of the persistent and recurrent chronic conjunctivitis, characterized by bulbar congestion, dilatation of the conjunctival vessels, pericorneal injection, lacrimation, photophobia, burning, and slight conjunctival secretion, Costi used biologic desensitization therapy. The desensitization was performed with injec-

tions of a concentrated tonsil extract processed by an anti-histaminic dialysis, combined with an autogenous vaccine from the nasal focus. Five cases are reported in detail. The bacteriologic data of the nasal and conjunctival cultures shows the favorable effect of the therapeutic pattern used.

Ray K. Daily.

Moutinho, H., Grilo, M., and DeMoura, S. **Treatment of trachoma with aureomycin ointment.** Arch. Soc. oftal. hispano-am. **9**:1098-1101, Oct., 1949.

On the basis of an experience with 39 cases of trachoma in various stages, the authors conclude that 1-percent aureomycin ointment, which is stable at room temperature, is the most effective agent for trachoma and trachomatous pannus. In most cases the vessels were found sclerosed after one or two weeks of treatment and the corneal complications cleared up rapidly. Inclusion bodies disappeared in a few days. The effect on the follicles was inconstant; in most cases they flattened at the end of one or two weeks, became transparent and disappeared without or with very fine cicatrization. The follicles of the fornix and the angles are the most resistant, because of their greater inaccessibility to the ointment, and it is advised that they be reached by direct application of the ointment on cotton or glass applicators. Brossage with the ointment intensified cicatrization. Ray K. Daily.

Romero, Eduardo. **My experience with five thousand cases of trachoma.** Arch. Soc. oftal. hispano-am. **9**:1107-1116, Oct., 1949.

An extensive experience in a trachomatous region made the author very sceptical of statistical conclusions, and convinced him of the predisposition to trachoma of children with a lymphatic diathesis. He believes that the diagnosis of trachoma does not require the simultaneous presence of granules, cicatrices, and pannus; any one of the three symptoms should be adequate. The use of the Desmarres elevator to expose the fornix will often facilitate the diagnosis. He proposes a new classification based on the degree of involvement of the palpebral conjunctiva, and of the cornea. He is very enthusiastic about the results of sulfa drugs taken internally, and does not agree with those who believe that the action of the sulfa drugs is limited to the superimposed infection; mechanotherapy limited to the surface of the lids in the form of massage with a cotton-wrapped finger, or expression with a Knapp forceps is useful; copper pencil applied to the everted lids is the local treatment of choice. Most patients are cured within four to six months. (6 figures.)

Ray K. Daily.

Silvan, Fernando. **The absorbtion spectrum in the ultraviolet zone of the serum of trachoma patients.** Arch. soc. oftal. hispano-am. **9**:1086-1097, Oct., 1949.

In the author's spectrographic studies the serum of trachoma patients does not show any significant deviation from the serum of normal subjects.

Ray K. Daily.

Stein, Albert. **A contribution to the treatment of corneal ulceration and particularly of serpiginous ulcer.** Arch. d'opht. **9**:722-731, 1949.

Stein reports on 27 cases of corneal ulceration, of which 16 were serpiginous in type, treated with penicillin by a combination of iontophoresis and continuous corneal bath. He used a special eye cup of bakelite containing an electrode and rimmed with a rubber sleeve to permit water-tight application. A wide elastic band passed around the head kept the cup close to the eye. The penicillin was used in a concentration of 20,000 units in 10 cc. of distilled water, and iontophoresis was ap-

plied in half-hour periods twice daily until all infiltration had disappeared. The amount of current was varied from 0.75 to 2.0 milliamperes according to the patient's tolerance. Between iontophoresis periods a penicillin bath of from 20,000 to 40,000 units in an artificial tear solution was continued over periods of from six to eight hours. After a short rest period in which mydriatics were instilled the bath could again be started.

The author states that in no case did the corneal ulcer progress after this treatment had been started. He stressed the fact that only penicillin-sensitive organisms were found in his cases and that no lacrimal sac involvement was present in the series. He considers his method definitely superior to previously described methods which rely on parenteral administration, subconjunctival injections, ointments, or drops. P. Thygeson.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Aznarez, Jose. **An authentic case of sympathetic ophthalmia.** Arch. Soc. oftal. hispano-am. **9**:1202-1209, Nov., 1949.

A case of sympathetic ophthalmia which developed six weeks after enucleation of the injured eye is reported. The right eye was perforated by a piece of bronze from a projectile; the bronze fragment was extracted from the anterior chamber, and the wound closed with a conjunctival flap. The eye developed an intense torpid iridocyclitis, with total loss of vision and was enucleated 28 days after the injury. Six weeks later the left eye developed visual cloudiness, and a plastic iridocyclitis; following the combined use of all therapeutic procedures for the disease the patient recovered with normal visual acuity. Reference is made to another case which the author saw in Germany in World War I. A twenty-year-old student suffered a peripheral corneal perforation with an intraocular foreign body which was extracted from the anterior chamber. The eye was enucleated promptly after the onset of sympathetic ophthalmia in the other eye. At the end of two years the sympathizing eye was still faring badly. The pathogenesis of sympathetic ophthalmia is discussed, and the author takes the position that its development is dependent upon a perforating injury associated with a plastic iridocyclitis. Ray K. Daily.

Bentley, Neil. **Iritis and iridocyclitis; review of past and present ideas.** J. Michigan St. M. Soc. **49**:166-173, Feb., 1950.

Dr. Bentley reviews the past ideas of symptoms, etiology and treatment. He also presents the present day concepts of symptoms and etiology, with special emphasis on his own methods of acceptable treatment based upon his years of experience. Theodore M. Shapira.

Nonnenmacher, Heinz. **Experiences with Franceschetti's korepraxy.** Klin. Monatsbl. f. Augenh. **115**:549-554, 1949.

The author made artificial new pupils in cases where the pupil was drawn up after operation or after trauma, or when it was blocked by organized inflammatory exudate. The operation was performed 13 times on 11 patients and was always successful. In a few instances the operation was followed by slight complications but they never resulted in a lasting ill effect. After paracentesis in the lower quadrant of the globe the author introduces a small hook to the margin of the pupil, pulls the iris down to the corneal wound and excises it. Usually an oval pupil results.

R. Grunfeld.

Toselli, Carlo. **Chest X-rays in anterior tuberculous uveitis.** Rassegna ital. d'ottal. **18**:407-413, Nov.-Dec., 1949.

Of 27 cases of allergic tuberculous an-

terior uveitis reported, no specific pleural or pulmonary changes were noted in eight. In two subjects, the chest X-ray film was entirely negative. Activity in the pulmonary tissue was noted in nine patients and hilar or mediastinal calcification was evident in five. Apical fibrosclerosis was seen in seven instances. Residual pleural changes showed up alone or in connection with other lesions six times. The author confirms the infrequency of acute uveal disease in association with severe pulmonary changes. Eugene M. Blake.

Vannini, Angelo. **Sympathetic ophthalmia treated with penicillin.** Rassegna. ital. d'ottal. **18**:414-423, Nov.-Dec., 1949.

The 23-year-old patient reported had suffered a penetrating wound of the cornea with iris inclusion, cataract, and retained intraocular foreign body. The latter was removed by the electromagnet. Gradually the eye became atrophic. Three months later evidence of sympathetic uveitis was present. 600,000 units of penicillin were administered intra-muscularly daily for some weeks and the dose was gradually reduced. Six months after the original injury the sympathizing eye had cleared and vision was 20/20. The histologic study of the enucleated eye is reported. (4 figures)

Eugene M. Blake.

9

GLAUCOMA AND OCULAR TENSION

Adler, F. H. **The treatment of glaucoma: the Schneider Foundation eye presentation.** Postgrad. Med. **7**:95-99, Feb. 1950.

Adler draws several analogies between chronic simple glaucoma and essential hypertension, and mentions the narrow angle and open angle types. The narrow angle type is characterized by frequent prodromal episodes, brought on occasionally by emotional upsets, and sometimes by pupillary dilatation. Peripheral iridotomy sometimes is sufficient if an acute attack is not present, a basal iridectomy if an acute attack has been present not more than 24 hours. If over 24 hours, iridencleisis is advised. 1-percent pilocarpine should be used periodically, and an extra drop put in before going to the movies or if awake at night. The open angle type will often be picked up only by routine tonometric measurement of people past 45 years of age. These cases should have a conservative prolonged test of control of the pressure with miotics. The water test is the best provocative test. Miotics are instilled at dinner time, bed time, and immediately upon awakening in the morning. If the visual fields deteriorate, surgery must be done, trephining, sclerectomy, and cyclodialysis. Operation should be done only if miotics have failed. In narrow angle type however, operation must be done early. Bennett W. Muir.

Brueckner, R., Hermann, C., and Jent-Peyer, S. **The effect of some physical and pharmacological factors upon the intraocular pressure.** Ophthalmologica **118**: 520-533, Oct.-Nov., 1949.

Since at least part of the fluid transfer out of the eye takes place through the drainage channels of the chamber angle and as the result of hydrostatic pressure differences, lowering of the head below the level of the heart should hamper this fluid transfer and thereby cause a rise of the ocular tension. The main object of the paper under review was to study the ocular tension in this position which may be described as a mitigated Trendelenburg's position. In man as well as in rabbits the essayists found the ocular tension to rise measurably upon lowering of the head. The topical application of eserine or prostigmine did not influence this rise in man. In rabbits under urethane anesthesia prostigmine and eserine caused a marked primary rise in ocular tension which was independent of the position of the animal.

The primary rise lasted 1 to 2 hours and was followed by a drop and one or several secondary rises of tension. The primary rise could be aborted or suppressed by the topical application of atropine. Most of the variation of tension observed by the authors seemed to be independent of the fluid outflow through the drainage channels of the chamber angle.

Peter C. Kronfeld.

Campos, Evaldo. **Transcorneal cyclodialysis.** Rev. brasil oftal **8**:191-202, March, 1950.

For greatly simplifying the cyclodialysis operation, the writer reminds the reader of the transcorneal technique recommended by his father, Edilberto Campos, in 1939. Forty-five such operations have been performed with an encouragingly high percentage of good results. Only four instruments are needed after the retrobulbar injection. The eyeball being firmly fixed by grasping the episcleral tissue through the conjunctiva, the lance knife is entered obliquely 2 or 3 mm. below the upper corneal limbus. The point of limit for the incision is indicated by a notch in the edge of the keratome (10 mm.). Without releasing the fixation, the appropriately curved spatula is then swept through an arc of 90 degrees to either side. Usually there is no bleeding, but a small amount of blood may appear in the anterior chamber, and occasionally the chamber is filled with blood, in which case a small compress may be applied. Absorption of hemorrhage is usually rapid. (4 figures, references.)

W. H. Crisp.

Filbry, E. **The etiology and genesis of simple glaucoma.** Klin. Monatsbl. f. Augenh. **115**:506-513, 1949.

The author considers a hereditary or constitutional parasympathetic hypotony to be the basic cause of chronic simple glaucoma. A second factor is necessary to make the disease manifest and this factor may be a sudden disturbance in the central regulation, a sudden disturbance in hormone production, or a diminution in acetylcholin or increase in cholinesterase production. Alcalosis of the blood may be a genetic factor. The author found that after hyperventilation the tension in glaucomatous eyes rose from 40 to 46 mm. Hg. In cardiac dyspnoea and acidosis the tension fell below normal in otherwise normal eyes. In glaucomatous patients the tension fell with anoxemia and rose when cardiac therapy was instituted. To prove his contention that acidosis will lower the tension the author prescribed medication to acidify the blood. In several patients with uncomplicated glaucoma the tension actually fell but in a few with complicated glaucoma the tension rose or remained unaffected.

R. Grunfeld.

Haselmann, Günther. **Examinations concerning glaucoma and general disturbances.** Klin. Monatsbl. f. Augenh. **115**:527-533, 1949.

To determine whether disturbed hormone production, disturbed bodily functions, or altered nutritional factors play any role in the etiology of chronic simple glaucoma various clinical tests were made on 20 normal subjects and on 20 with glaucoma. In glaucoma the basal metabolism was increased to +23 and a disturbance in the sugar tolerance was observed. The blood cholesterol values were about normal and the water drinking and concentration tests were negative.

R. Grunfeld.

Lewis, P. M. **Glaucoma—Surgical complications.** J. Tennessee St. M. A. **43**:44-47, Feb., 1950.

Iridectomy is used principally for narrow angle glaucoma in the acute stage or in the period immediately following the

acute attack, and is generally done in local anesthesia. An ab externo incision is advocated. A patient's misbehavior is the result of poor preparation. If in a trephining operation the flap is buttonholed, and cannot be closed easily, the author advocates moving to either side or below and continuing the operation there. Treatment of post-operative iritis is with neosynephrine, atropine, heat and milk injection. If the anterior chamber has not been restored in seven days he injects air. He has never had an eye that showed degeneration after marked hypotony. For an iridencleisis he advocates an ab externo incision. Air is injected if the anterior chamber has not reformed in a week. Early massage keeps the wound open, and is advocated. Clyclodialysis is used only in aphakia. Air was injected once into the vitreous by mistake, without damage. Miotics are used daily. The operation may be repeated. He has done nonperforating diathermy seventeen times, and considers it especially valuable in uncontrolled glaucoma secondary to uveitis. On three of these eyes the surgery had to be repeated.

Bennett W. Muir.

Pau, Hans. **Simple glaucoma as a result of atony in the ciliary muscle in consequence of existing sympathicotonus.** Klin. Monatsbl. f. Augenh. **115**:513-524, 1949.

Sympathicotonus is a very common sign in chronic simple glaucoma. Its existence is indicated by the fall of tension after the injection of ergotamin, which paralyzes the sympathetic. Extirpation of the sympathetic ganglion causes a transient drop in ocular tension. Emotional disturbances, with an outpouring of adrenalin into the blood, raise the general blood pressure and the ocular tension at the same time but independently. Early presbyopia which is common in glaucoma may be the expression of increased sympathicotonus. When accommodation was induced the tension fell from 2 to 22 mm. Hg in glaucomatous eyes but remained unaffected in secondary glaucoma or in glaucomatous eyes which had been operated upon. The fall of tension with accommodation probably results from an emtying of the overfilled uveal blood vessels.

R. Grunfeld.

Radnót, M. **The formation of hypotony produced through castration.** Klin. Monatsbl. f. Augenh. **115**:524-526, 1949.

Experiments on rabbits showed that the ocular tension falls 24 hours after unilateral castration in the contralateral eye, unless the sympathetic ganglion has been cut on the same side two weeks before the castration was done.

R. Grunfeld.

Redslob, E. **The causes of failure in fistulating operations in the light of pathologic examinations.** Ann. d'ocul. **183**:1-15. Jan., 1950.

Nine cases are described in detail to illustrate the causes and pathology of failure in filtering operations. Eight sections of enucleated eyes are presented to show accompanying changes. Six were trephine operations, two, Lagrange operations, and one was cyclodialysis. Failure in trephine operations was due to incorrect placement or direction of the trephine, too much force, and infection. In the cyclodialysis and Lagrange operations, the sections were too corneal. Ciliary body lesions were present in all cases.

Chas. A. Bahn.

Reiser, K. A. **The scleral-diathermy puncture, a simple glaucoma operation.** Klin. Monatsbl. f. Augenh. **115**:491-500, 1949.

The author reports good results with nonperforating scleral-diathermy punctures. The conjunctiva is incised in the lower quadrants parallel with and 10 mm. from the limbus. The incision extends

from the lateral to the medial rectus. These muscles and the inferior rectus muscle are dissected and pulled aside during the operation. The diathermy punctures are made 8 mm. from the limbus with a wire 1.5 mm. in diameter and one puncture is placed close to another. The strength of the current is so regulated that the punctures result in a dark brown scleral discoloration with a black ring in 10 seconds. During the operation the ocular tension rises to more than 90 mm. Hg but eventually, on instillation of pilocarpine and laevoglaucosan the pressure falls without leaving ill effects. If necessary, the operation can be repeated in the upper quadrants after ten days. The advantages of this operation are its easy technique, the prompt reduction of tension, and the fact that the anterior portion of the eyeball remains unaffected, so that successive operations can be performed.

R. Grunfeld.

Remky, H. **Atropine as a tension-reducing agent in juvenile glaucoma.** Klin. Monatsbl. f. Augenh. 115:539-543, 1949.

In two patients with posterior corneal embryotoxon the normal tension fell after the instillation of atropine. The embryotoxon is a form of mesodermal dysgenesis and a sign of malformation of the corneoscleral angle and may appear with hyperplasia or hypoplasia of the iris tissue. It is often associated with hydrophthalmos and coloboma of the iris and choroid. The author used atropine in five cases of juvenile glaucoma with signs of dysgenesis mesodermalis and in six of hydrophthalmos with and without signs of dysgenesis. In 10 cases the tension fell and was kept low with atropine, and rose slightly in one. The effect can be attributed to the fact that atropine retards the activity of secretory glands. The dilatation of the pupil and the obstruction of the iridocorneal angle is without significance because of the absence or malformation of Schlemm's canal. R. Grunfeld.

Sautter, Hans. **Our experiences with cyclodiathermy punctures.** Klin. Monatsbl. f. Augenh. 115:481-491, 1949.

The author analyzes his experience gained from 127 cyclodiathermy operations on 100 eyes. On 25 eyes the operation was performed twice and on one three times. In 53 cases cyclodiathermy punctures were selected as the primary operation and in 47 cases after other operations failed. Cyclodiathermy as the primary operation was less efficient in lowering the ocular tension than were fistulizing operations and the tension rose more often after an initial fall. Much better results were achieved in secondary glaucoma with cyclodiathermy punctures as the primary operation. Such was the case in aphakia, in a case of thrombosis of the central retinal vein, and in one case of sympathetic ophthalmia where no other operation could be considered. The operations were successful in half of the cases. The complications were about the same as are encountered with fistulizing operations. The value of cyclodiathermy punctures is increased when precise indications are adhered to, but it has merit not only as a secondary operation but as a primary operation, too. R. Grunfeld.

Scharf, J. **A diascleral and subscleral iridencleisis for glaucoma.** Klin. Monatsbl. f. Augenh. 115:500-506, 1949.

The author describes a new operation which, he found subsequently, had been described earlier by four men independently. Since gonioscopic observation made it clear that cyclodialysis remains successful only in those cases in which the artificially produced cleft remains open, the author endeavors to achieve this condition by inserting the iris into the scleral-choroidal opening. After having per-

formed the cyclodialysis operation in the regular manner, he carries a thin iris forceps into the anterior chamber through the sclero-choroidal opening. He grasps the iris close to the pupillary margin and pulls it out into the scleral wound. Here he divides the sphincter, and leaves the iris in the scleral wound covered by conjunctiva only. Thus he produces a cyclodialysis and iridencleisis at the same time. The conjunctiva in this region is thicker than near the limbus and the danger of infection is less. Operations performed on two blind eyes were successful.

R. Grunfeld.

10

CRYSTALLINE LENS

Clark, W. B. **The important complications of cataract surgery (exclusive of sympathetic ophthalmia).** New Orleans M. and S. J. **102**:248-259, Nov., 1949.

The author agrees with Spaeth that in no other operations anywhere in the body are there more possible complications than in cataract extraction. Treatment of each complication is mentioned or described. Francis M. Crage.

Hartmann, Edward. **Air injection into the anterior chamber after cataract extraction.** Ann. d'ocul. **183**:64-65, Jan., 1950.

This valuable surgical adjunct was first employed by Elschnig. It facilitates reformation of the anterior chamber and tends to prevent iris incarceration. The author uses a 15 mm. fine-caliber needle with a shortened point. The air is sterilized with heat and the needle is inserted preferably in the temporal part of the incision. Less air is used in peripheral iridectomies or iridotomies than in complete iridectomies. The air is completely absorbed between the third and seventh day. Striped keratitis is more visible in the area of the air injection. The author considers this procedure of special value in intracapsular extractions. Chas. A. Bahn.

Legrand, J. **Punctate cataract and tuberculosis.** Ann. d'ocul. **183**:58-63, Jan., 1950.

In 37 patients with punctate lens opacities, 30 or approximately 80 percent had or had had presumptive bodily tuberculosis or a history of tuberculosis in their immediate families. These patients had been observed for as long as 15 years. The lens opacities varied in size and number but all were located in the adolescent or adult nucleus. In the explanation of this unusual association, the author briefly discusses the possibilities of coincidence, toxic reactions from tuberculosis and metabolic disturbances associated with tuberculosis. He believes the dominant factor is defective calcium metabolism at the time the adolescent and young adult nucleus is being formed. Treatment of these opacities with calcium and vitamin D has been without effect.

Chas. A. Bahn.

Meisner, W. **Cataracta complicata after chronic iridocyclitis: its operation and prognosis.** Klin. Monatsbl. f. Augenh. **115**: 543-548, 1949.

Forty eyes of 32 patients with complicated cataract after chronic iridocyclitis were operated upon without complication. The visual end result in each eye depended upon the damage produced by the underlying disease process. Intracapsular extraction is the operation of choice and no eye must be operated upon unless it has been free of any sign of inflammation for several months. R. Grunfeld.

11

RETINA AND VITREOUS

Cardello, Giovanni. **Two cases of central retinitis pigmentosa.** Rassegna ital. d'ottal. **18**:396-406, Nov.-Dec., 1949.

The two patients described were 63 and 78 years old. The first had a somewhat reduced vision for a long time but both

described fairly recent failure of sight. In neither was there any history of consanguinity or similar affection in other members of the family. Both presented the picture of topetoretinal degeneration of the area about the macula and a small ring-shaped scotoma surrounded the fixation point; peripheral fields were normal and the pigment-particles were similar to those of regular pigmentary degeneration of the retina. Eugene M. Blake.

Lijó Pavía, J. **Photography of the central artery and vein of the retina and provocative pulse.** Rev. oto-neuro-oftal. **24**: 21-22, March-April, 1949.

This short paper simply describes the showing of a film comprising the hypertensive fundus, the double retinal pulse, and the changes due to variations in the intraocular pressure. Edward Saskin.

Lijó Pavía, J. **Efflorescence in the retina due to coccidioidomycosis.** Rev. oto-neuro-oftal. **24**:65-70, July-Aug., 1949.

A case of coccidioidomycosis is reported which showed typical nodular flowery cystic masses occupying the lower half of each foveal area. (1 retinogram.)
Edward Saskin.

Lijó Pavía, J., and Lis, M. **Benign retino-hypophysary syndrome. Thirty observations.** Rev. oto-neuro-oftal. **24**:41-45, and 73-75, May-June, and July-August, 1949.

The hormonal treatment of certain pituitary alterations associated with divers retinal pictures is outlined after a brief discussion of pituitary anatomy and physiology, visual acuity and the physiological relationship of vision and the pituitary. The symptomatology comprises general derangements of internal secretion and ocular changes, glycosuria, and alterations in the region of the sella turcica. The onset of the syndrome is manifested by headache, psychic disurbances, vertigo, and diminution of vision. The ocular picture is one of retinal vessel caliber changes, optic neuritis, and even atrophy. The sella shows decalcification and osteolysis of the posterior clinoids.

One group of nine cases, all in women, showed supranasal visual field contraction and decalcification of the posterior clinoids. Treatment with lobulantine (gonadotropic hormone) resulted in general improvement and increase in visual acuity. Another group of women showing similar sellar changes associated with psychic and endocrine dysfunction, optic neuritis and macular edema, also improved under similar treatment. A group of men and another group of adolescents with similar findings improved likewise.
Edward Saskin.

Lijó Pavía, J., Puente, M. C., and Lis, M. **Hypertensive retinal angiopathy in relation to coronary sclerosis.** Rev. oto-neuro-oftal. **24**:97-99, Sept.-Oct., 1949.

Six cases of hypertension and coronary sclerosis are presented which showed fundus changes including angiospasm, cholesterin deposition in the macula, early foveal degeneration, optic neuritis, foveal edema, retinal hemorrhages, and pigmented retinal atrophic areas.
Edward Saskin.

Panepinto, V., and Lo Cascio, G. **Filatov's tissue therapy for retinosis pigmentosa: injections of watery extract of aloe leaves.** Boll. d'ocul. **28**:621-624, Oct., 1949.

Following Filatov's method exactly, the authors treated seven patients for pigmentary retinal degeneration; the results were nil. K. W. Ascher.

Weekers, Roger. **Retinal vascular accident following cerebral arteriography.** Ann. d'ocul. **182**:926-930, Dec., 1949.

Because of possible intracranial tumor, cerebral arteriography was performed by the injection of 20 cc. umbradil into the right carotid of a 42-year-old woman. Im-

mediately after the injection, epileptiform convulsions and left hemiplegia developed. Five days later a large white zone of retinal edema was observed in the lower part of the left fundus. Regression began within a week, and four months later the only evidence of the ocular lesion was a slight peripheral field contraction. Because of the rapid onset, clinical appearance and course, the author believes that the lesion was probably the result of arterial spasm. The possibility of a gaseous or solid embolism is briefly discussed. Chas. A. Bahn.

12

OPTIC NERVE AND CHIASM

Bregeat, P., and David, M. **Acute edema of the optic nerve. Its clinical aspect and surgical treatment.** Rev. oto-neuro-oftal. **24**:25-27, March-April, 1949.

This condition is associated with rapid blindness. It frequently results from strangulation of the optic nerve within the osseous canal. The factors involved are both inflammatory and mechanical. The surgical treatment is a partial removal of the osseous optic canal which usually results in relief for the strangulated nerve and a return of vision.

Edward Saskin.

Chamlin, Max, and Davidoff, L. M. **Drusen of optic nerve simulating papilledema.** J. Neurosurg. **7**:70-78, Jan., 1950.

Drusen are hyaline substances occasionally found in or on the papillary portion of the optic nerve. They may produce a picture resembling papilledema, especially the latter group. The authors had seven cases, of which four had been seen by ophthalmologists and neurologists who called them papilledema. The drusen may be visible or merely suspected. If they are visible, there is some yellow or whitish amorphous hyaline substance distributed within and on the surface of the disc and reaching out on to the retina, thus giving the appearance of atrophy plus blurring. The blind spots are enlarged, and there is often a peripheral field defect. Hemorrhages, exudates, and venous engorgement are not present. Diagnosis is made by ophthalmoscopic examination, history, field changes, and neurologic and laboratory investigations. These cases should be followed, to confirm the diagnosis by the fact that the picture does not change whereas it does in papilledema. The record of all ophthalmologic examinations should have a note on the disc, with particular reference to margins, color, cup, and calibre of vessels, to be used in the future if necessary. (11 figures, references.)

Bennett W. Muir.

Haupt, P. **Successful treatment of luetic optic atrophy with penicillin.** Klin. Monatsbl. f. Augenh. **115**:611-618, 1949.

Three patients with optic atrophy of leutic origin were treated with intramuscular injections of penicillin. Five million Oxford units were given in divided doses at two or four hour intervals. The visual fields improved considerably but not the visual acuity. R. Grunfeld.

Pagliarani, N. **The retinal arterial pressure in some forms of optic nerve atrophy.** Riv. oto-neuro-oftal. **24**:471-496, Nov.-Dec., 1949.

There was no uniformity of the results in ophthalmodynamometric measurements in 100 cases of optic atrophies of such various etiology as tabes, taboparalysis, optochiasmatic arachnoiditis, tumors of the sellar region and anterior cranial fossa, vascular lesions and primary glaucoma. Melchior Lombardo.

13

NEURO-OPHTHALMOLOGY

Adler, Alexandra. **Course and outcome of visual agnosia.** J. Nerv. and Ment. Dis. **111**:41-51, Jan., 1950.

This is a further study on a 22-year-old

woman who had suffered a permanent disability in 1942 at a fire at the Cocoanut Grove Night Club. It is believed that carbon monoxide fumes caused the damage to her brain. At this time she still cannot perceive the whole visually, perceiving only parts without realizing their integral relations. Patterns made of curves are impossible for her to recognize. She cannot read handwriting nor differentiate fingers. She cannot calculate and cannot hold a job. Her handwriting is deteriorating. Outwardly, however, she apparently leads an almost normal life.

Bennett W. Muir.

Andre-Van Leeuwen, M., and Van Bogaert, L. **Hereditary ataxia with optic atrophy of the retrobulbar neuritis type, and latent pallido-luysian degeneration.** Brain **72**:340-363, part 3, 1949.

Hereditary cerebellar ataxia of Marie's type, like late cortical cerebellar atrophy (Marie-Foix-Alajouanine), may be accompanied by pallido-luysian degeneration. In the cases observed by the authors this atrophy was clinically latent and this latency may be due to the fact that pallido-luysian degeneration represents a late phase in systemic degeneration, whereas in other families it is chronologically and quantitatively in the foreground of the degeneration in the spinocerebellar or even in the spinopontocerebellar complexes. The significance and clinical expression of this striatal extension of hereditary spinopontocerebellar degeneration deserves the attention of observers in the same way as does the mesencephalocerebellar extension of hereditary cerebello-extra-pyramidal degeneration. The first landmarks are placed by the olivopontocerebellar degenerations. Cortical atrophies may be a similar material of choice. It may be accompanied by systemic atrophy of the papillomacular bundle manifest clinically in the form of bilateral retrobulbar neuritis. These investigations confirm the earlier data regarding the position of this bundle in the optic tract. Systemic atrophy of the papillomacular bundle has probably been observed before in other cases of hereditary ataxia but its frequency and its clinical forms cannot yet be fixed because of the lack of definite clinical and pathologic documentation. There are two other types: severe optic atrophy of early onset and global, slowly progressive optic atrophy. The cases of hereditary degeneration associated with the first and third types have no special distinguishing features, but in those in which the optic atrophy is of the second type the neurological affection, whatever it may be, is more serious and appears earlier. In such cases the degeneration seems to affect several neurones at once with interfamilial variations. At present, however, the documents which can be utilized are too few to allow one to think of drawing any more general genetic conclusions.

Bennett W. Muir.

Jaeger, Rudolph. **Aneurysm of the intracranial carotid artery. Syndrome of frontal headache with oculomotor nerve paralysis.** J.A.M.A. **142**:304-309, Feb. 4, 1950.

Thirty-one consecutive cases of aneurysm of the intracranial portion of the carotid artery with the common symptoms of unilateral, orbital and frontal headache and manifestation of involvement of the third cranial nerve have been analyzed in sufficient detail to point ou' the general pattern of these two symptoms. Other commonly associated observations, such as generalized headache, meningismus, mental disturbances, involvement of the other cranial nerves, and particularly of the fourth and sixth, are emphasized. In this series the radiographic study after injection of a contrast medium was very valuable in a precise diagnosis which disclosed the shape and

size of the aneurysm and the chances of a reasonably safe surgical cure. Five patients died after a craniotomy was made in an attempt to treat the aneurysms. This is not a prohibitive mortality in view of the probable outcome if the patients are not treated and in the light of limited past experiences to guide the surgeon in this relatively newly recognized group of surgical lesions.

All adults with a persistent frontal or orbital pain or ache, associated with a third nerve paresis or paralysis, should be suspected of having an aneurysm of the intracranial carotid artery. With these symptoms, arteriography is indicated in every instance to confirm the diagnosis and to determine the feasibility for direct surgical treatment. Most of these patients can be relieved or cured by specific surgical procedures without a great or unnecessary risk. Theodore M. Shapira.

14

EYEBALL, ORBIT, SINUSES

Sippl, Florian. **Bilateral metastatic ophthalmia cured with penicillin.** Klin. Monatsbl. f. Augenh. **115**:605-611, 1949.

A 40-year-old man with bilateral septic ophthalmia was successfully treated with penicillin and a good visual result was obtained. The ophthalmia originated from a furuncle in the inner side of the nose. Five million units of penicillin were given by subconjunctival and intramusular injections. Formerly the rate of mortality of similar cases was 63 percent and many others ended in blindness. R. Grunfeld.

15

EYELIDS, LACRIMAL APPARATUS

Hambresin, L. **The treatment of spastic entropion by external tarsorrhaphy and alcohol lid injection.** Ann. d'ocul. **182**:931-935, Dec., 1949.

The author considers these two procedures the only cures for spastic entropion. The lower lid is practically always involved because its tarsus is more thin and straight, permitting the marginal fibers of the orbicularis to invert it more easily, especially in the aged. After cocainization of the upper and lower lids a mark is placed on both lid margins 3 mm. or less from the outer canthus. The entire tissue of the lids, including the lashes, external to the mark, is excised and a vertical sliding flap is prepared. Two silk sutures are inserted for coaptation. Both eyes are bandaged for 48 hours to insure complete immobility. The diminished size of the palpebral opening by 3 mm. or less is seldom disfiguring.

In spastic entropion following cataract or other ocular operations, or if a patient objects to tarsorrhaphy, the procedure of choice is alcohol injection of the lid. A 4-percent solution of novocaine is injected along the entire length of the lid 3 mm. from its margin. After several minutes, 0.5 to 0.75 cc. of 80-percent alcohol is injected along the same tract. Small spots of necrosis of the skin occasionally occur, which favor healing by increasing cicatrization. Sclerosing substances such as tincture of iodine, urea, and quinine may be added to the alcohol. Canthotomy performed at the same time has also been recommended. Chas. A. Bahn.

Hatschek. **A simple operation for ectropion of the lower lid.** Klin. Monatsbl. f. Augenh. **115**:555-556, 1949.

An incision, 3 to 4 mm. long, vertical to the lower conjunctival fold, and 2 to 3 mm. medial to the lacrimal punctum and below the lacrimal duct is made through conjunctiva and tarsus. From the two edges converging incisions are made to the middle of the lid. The triangle which consists of conjunctiva and tarsus is cut out. The wound is closed with a running suture. R. Grunfeld.

Henry, Louis. **Tarsal resection and canthoplasty in the operation of trichiasis.** Arch. d'opht. **9**:708-721, 1949.

Henry advocates complete excision of the tarsus in cases of cicatricial trachoma complicated by trichiasis, and describes his technique for this operation which includes a canthoplasty. He believes that removal of the tarsus removes a focus of secondary infection and relieves corneal irritation. He advocates the use of penicillin to reduce postoperative inflammation. P. Thygeson.

Trabut, G. **Entropion-trichiasis in North Africa. Its surgical correction by the conjunctival route.** Arch. d'opht. **9**:701-707, 1949.

In North Africa the majority of adults with trachoma have entropion of major or minor degree and surgical correction is required in those with deviation of the cilia sufficient to injure the cornea. The author describes a simple operative treatment which he states can be used when necessary by general physicians in isolated areas in which ophthalmological care is not available. The operation consists essentially in a horizontal section of the tarsus 2 to 3 mm. from the lid margin. It is made from the conjunctival side, the skin and subtarsal tissues being left intact. By means of sutures the narrow lower portion of the tarsus is pivoted 180 degrees. The larger, upper portion is then brought down so that the two cut edges of the two tarsal portions together form a new lid margin, with the result that the cilia are not only turned away from the globe but are separated 2 to 3 mm. from the new lid margin. The operation may be performed on either lid but on the lower lid the tarsal incision should be not more than 2 mm. from the lid border. Overcorrections are not to be feared in this procedure. P. Thygeson.

Veirs, E. R. **Surgical treatment of lacrimal drainage system.** Texas St. J. M. **46**:111-113, Feb., 1950.

Stenosis of the nasal lacrimal duct is treated by probing in infants with a frank dacryocystitis and in patients who have an appreciable amount of conjunctivitis, regardless of age. For strictures of the canaliculi a plastic rod (size 4 Bowman) was inserted in the lower canaliculus and held in position for several days by adhesive. Complete strictures were hard to correct. Streptothrix is often overlooked but lavage with penicillin or a sulfa drug after removal of concretions usually suffices. Closure of a canaliculus by diathermy for keratoconjunctivitis sicca is simple and helpful. Dacryocystorhinostomy is briefly outlined.

Francis M. Crage.

PAN-AMERICAN NOTES

Edited by MANUEL URIBE TRONCOSO, M.D.
500 West End Avenue, New York 24

Communications should reach the editor by the 12th of the month

BRAZIL

ESCOLA PAULISTA DE MEDICINA

During the month of January, the XIV Postgraduate Course in Ophthalmology, organized by Dr. Moacyr E. Alvaro, professor of ophthalmology of the Escola Paulista de Medicina, was held. This course consists of a "brush-up" on ophthalmic subjects, both routine and present-day therapeutics. The XV Postgraduate Course in Ophthalmology will be held in January, 1951.

On February 28th the Ophthalmological Clinic of the Escola Paulista de Medicina celebrated its 13th birthday. In the evening a meeting was held at the Centro de Estudos de Oftalmologia. Dr. José Ribeiro do Valle spoke on "Graduate and postgraduate teaching."

On March 7th, Dr. Durval Prado gave the first class in ophthalmology for the 1950 academic year of the Escola Paulista de Medicina. His subject was "The phenomenon of pain in ophthalmology."

As this number of the JOURNAL goes to press we regret to announce the death of Dr. Manoel Antonio de Silva which occurred suddenly on March 5th. He was an excellent doctor, a good friend, and a loyal assistant, and with his death, Brazil loses a valuable ophthalmologist.

VI BRAZILIAN CONGRESS OF OPHTHALMOLOGY

The meetings of this congress were held in the city of Recife. They were very well attended by more than 80 ophthalmologists, including delegates from some foreign societies. The program included: "An official report on ocular manifestations of tropical diseases," Dr. Breno Furtado Gomes; "The eyeground in essential hypertension and treatment by surgical intervention," Dr. Federico Cerboni; "Discromatopsia: Its classification and clinical features," Dr. Evaldo Campos; "Intraocular tumors," Dr. Queiros; "Prevention of blindness in Brazil," Dr. Colombo Spinola; "Penicillin therapy in ophthalmology," Dr. Santos; "Ophthalmological bases for the classification of pemphigus foliaceus," Dr. Amendola.

In addition to the official papers, many free papers were read. An innovation in this congress was the giving of several courses. The social part of the congress, characterized by regional feasts, was well attended by the members and their families.

VII BRAZILIAN CONGRESS OF OPHTHALMOLOGY

The preparatory committee has been meeting regularly to organize the VII Brazilian Congress of Ophthalmology, scheduled to convene in Quitandinha, July 9 to 15, 1951. The following official speakers and subjects have been chosen: Centro de Estudos de Oftalmologia: Dr. Rubens Belfort de Mattos, "Tissue therapy"; Sociedade de Oftalmologia de São Paulo: Dr. Paulo Braga Magalhães, "Semiology of the pupil"; and the Sociedade de Oftalmologia e Oto-Rino-Laringologia de Rio Grande do Sul: Dr. Luiz Assumpção Osorio, "Ametropias and their correction in infancy."

ELECT OFFICERS

At a meeting held on October 10th, the Sociedade de Oto-Rino-Laringologia do Rio de Janeiro elected new officers: Honorary president, Prof. João Marinho; president, Dr. Aloysio Novis; vice-president, Prof. José Kós; 1st secretary, Dr. Rubens Cabral; 2nd secretary, Dr. Meirelles Vieira; treasurer, Dr. Milton de Carvalho; orator, Prof. Chryso Fontes; librarian, Dr. Mauricio Adler.

SÃO PAULO MEETING

The Sixth Brazilian "Jornadas" of Ophthalmology will be held in Sao Paulo, September 3 to 7, 1950. These meetings are held in the years between national congresses in order to keep the ophthalmologists together. The "Jornadas" this year will be sponsored by the Centro de Estudos de Oftalmologia and the Sociedade de Medicina e Cirurgia de São Paulo has also promised its support to the project.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month but, to receive adequate publicity, notices of postgraduate courses, meetings, and so forth should be received by the editor at least three months before the date of occurrence.

Deaths

Dr. Harvey D. Lamb, Saint Louis, Missouri, died April 6, 1950.

Dr. Harvey Ollis Randel, Oklahoma City, Oklahoma, died February 17, 1950, aged 55 years.

Announcements

Medical illustrators' directory

The June issue of *Graphics*, the official publication of the Association of Medical Illustrators, contains the name, address, training, professional experience, and reference to major published work of each member, as well as other information pertaining to the profession.

This directory issue is available to those requiring medical illustration service. It will be sent, free of charge, upon request to the editor, Miss Helen Lorraine, 5212 Sylvan Road, Richmond 25, Virginia.

Orthopic examinations

Applications for the annual examination of orthoptic technicians to be conducted in September and October will not be accepted after July 1st. Application should be addressed to the secretary of the American Orthoptic Council, Dr. Frank D. Costenbader, 1605 22nd Street, N.W., Washington 8, D.C., and must be accompanied by the examination fee of $25.00.

Miscellaneous

Braille and sight-saving classes

The Catholic University, Washington, D.C., will conduct a new course to train teachers of sight-saving classes and teachers of Braille classes from June 26th to August 5th. Clinics and lectures will be given. For further information address: Mr. Roy J. Deferrari, office of the secretary general, Catholic University, Washington, D.C.

Tulane research grant

The Tulane University School of Medicine, New Orleans, Louisiana, has received a $50,000 grant from the Edward G. Schlieder Educational Foundation of New Orleans to establish an expanded program of research and graduate teaching in diseases of the eye.

A laboratory for eye pathology will be set up in the new wing of the eye, ear, nose, and throat hospital, and a laboratory of eye bacteriology for diagnosis and research will be established in the Hutchinson Memorial Hospital.

In addition to the expansion of the course in the basic sciences of ophthalmology which has been given by the department of ophthalmology of Tulane University for the past several years, several short courses for specialists in ophthalmology will be added to the postgraduate curriculum for next year.

Societies

Virginias meet

A joint meeting of the West Virginia Academy of Ophthalmology and Otolaryngology and the Virginia Society of Ophthalmology and Otolaryngology was held on May 8th and 9th at the Greenbrier, White Sulphur Springs, West Virginia.

Among the papers presented on the first day were: "Histaminic cephalgia," Dr. Bayard T. Horton, Rochester, Minnesota; "Cataract wound closure with 6-0 absorbable gut," Dr. Bruce Fralick, Ann Arbor, Michigan (discussion by Dr. Harry V. Thomas, Clarksburg, West Virginia); "Rhinological aspects of chronic dacryocystitis," Dr. Francis H. McGovern, Danville, Virginia; "The selection of surgery of the vertical muscles," Dr. William P. McGuire, Winchester, Virginia; "Implantation cyst of the conjunctiva: A case report," Dr. Edward W. Perkins, Richmond, Virginia; "Dacryocystorhinostomy," Dr. Arthur C. Chandler, Charleston, West Virginia (discussion by Dr. Ivan Fawcett, Wheeling, West Virginia).

Papers read on the second day were: "Diseases and treatment of the hard and soft palate," Dr. Fred Dixon, Cleveland, Ohio (discussion by Dr. Sobisca S. Hall, Clarksburg, West Virginia); "Ocular therapeutic principles and practical application," Dr. Edwin B. Dunphy, Boston, Massachusetts; "Nasal allergy," Dr. Frederick C. Reel, Charleston, West Virginia (discussion by Dr. R. M. Ferrell, Lewisburg, West Virginia); "The endaural approach for surgery of the mastoid and temporal bone," Dr. Houston L. Bell, Roanoke, Virginia, and Dr. Fletcher D. Woodward, Charlottesville, Virginia.

Officers of the West Virginia Academy are: Dr. Garnett P. Morison, Charles Town, president; Dr. Charles T. St. Clair, Bluefield, first vice-president; Dr. Arthur C. Chandler, Charleston, second vice-president; Dr. Frederick C. Reel, Charleston, treasurer; Dr. Melvin W. McGehee, Huntington, secretary; Dr. Eugene C. Hartman, Parkersburg, and Dr. Ivan Fawcett, Wheeling, directors.

Dr. Francis H. McGovern, Danville, is president of the Virginia Society. Other officers are: Dr.

Charles A. Young, Roanoke, president-elect; Dr. Frederick Morrison, Lynchburg, vice-president; Dr. Peter N. Pastore, Richmond, secretary-treasurer. Members of the executive council are: Dr. Fred E. Hamlin, Dr. Thomas E. Hughes, Dr. W. Wallace Gill, Dr. Elbyrne G. Gill, Dr. Francis S. Lee, and Dr. William P. McGuire.

Brooklyn program

At the 120th regular meeting of the Brooklyn Ophthalmological Society at the Brooklyn Eye and Ear Hospital, the following cases were reported: "Alexia," Dr. John H. Bailey; "Lymphosarcoma of the lid and conjunctiva," Dr. Jesse M. Levitt; "Kerito-uveitis of the left eye," Dr. William J. Fagan; "End result of B. pyocyaneous infection of the right eye," Dr. Abraham M. Sands; "Laurence-Moon-Biedel syndrome," Dr. Ira Mensher; "Beryllium granulomas of the face, lid, and conjunctiva," Dr. A. Benedict Rizzuti.

Milwaukee meeting

At the April meeting of the Milwaukee Oto-Ophthalmic Society, Dr. Erving Cowan presented a paper on "Diagnosis and therapy with radioactive isotopes."

New York Society officers

The newly elected officers of the New York Society for Clinical Ophthalmology are: President, Dr. Samuel Gartner; vice-president, Dr. Adolph Posner; recording secretary, Dr. Bernard Kronenberg; corresponding secretary, Dr. Leon H. Ehrlich; treasurer, Dr. Edward Saskin; historian, Dr. Frederick Theodore. Committee chairmen are: Program, Dr. Abraham L. Kornzweig; instruction session, Dr. Max Chamlin; legislative, Dr. Howard Agatston; membership, Dr. Bernard Fread; industrial, Dr. David A. Newman.

Dr. Sidney A. Fox, the retiring president, was elected to the advisory council.

Gill meeting

There was a total attendance of 250 at the 23rd annual spring congress of the Gill Memorial Eye, Ear and Throat Hospital, Roanoke, Virginia. The 24th annual spring congress will be held from April 2 to 7, 1951.

Personal

Dr. James H. Allen, formerly professor of ophthalmology at the University of Iowa, has been appointed professor of ophthalmology, Tulane University of Louisiana School of Medicine. Dr. Allen assumed his duties on March 1st and will be in charge of all ophthalmic research projects as well as the postgraduate courses in ophthalmology. Dr. William B. Clark will remain as chairman of the department and coördinator of all the affairs in the department.

The University of Toronto, Faculty of Medicine, announces renewal of the Canadian National Institute for the Blind Fellowship in Ocular Genetics. The grant is $2,000.00 for research in this field. This fellowship was held during 1949-1950 by Dr. L. A. Probert of Moose Jaw, Saskatchewan, who has been carrying on studies of the hereditary aspects of glaucoma. Dr. G. A. Thompson of Richmond Hill, Ontario, has been appointed to continue these studies next year through funds provided by this fellowship.

Dr. Kenneth C. Swan, Professor of Ophthalmology, University of Oregon Medical School, Portland, Oregon, gave the first Walter R. Parker Lectureship in Ophthalmology at the University of Michigan Medical School at the annual Spring Postgraduate Course in Ophthalmology on April 25th. The subject of his lecture was "Some contemporary concepts of scleral disease."

CONDENSED CHAPTERS FROM

The History of the Guild

THE PHILADELPHIA GUILD

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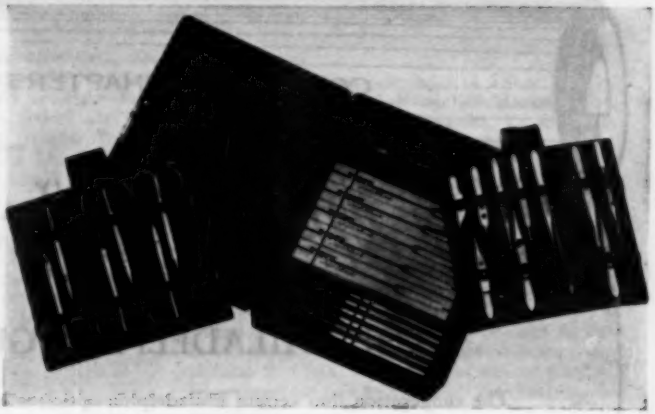

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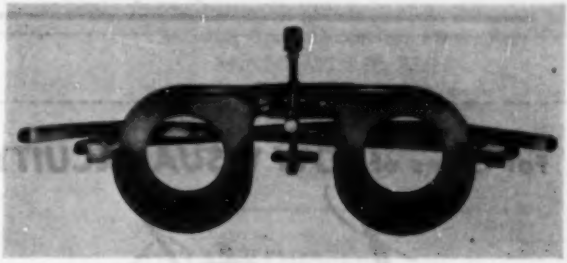

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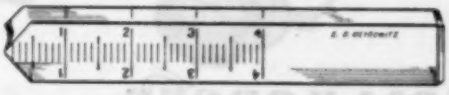

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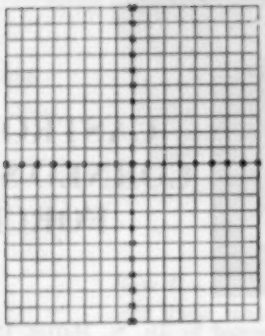

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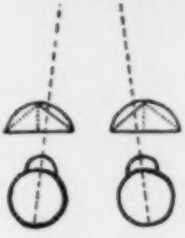

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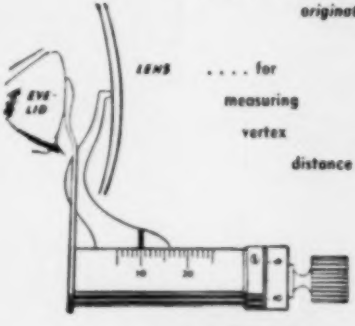

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